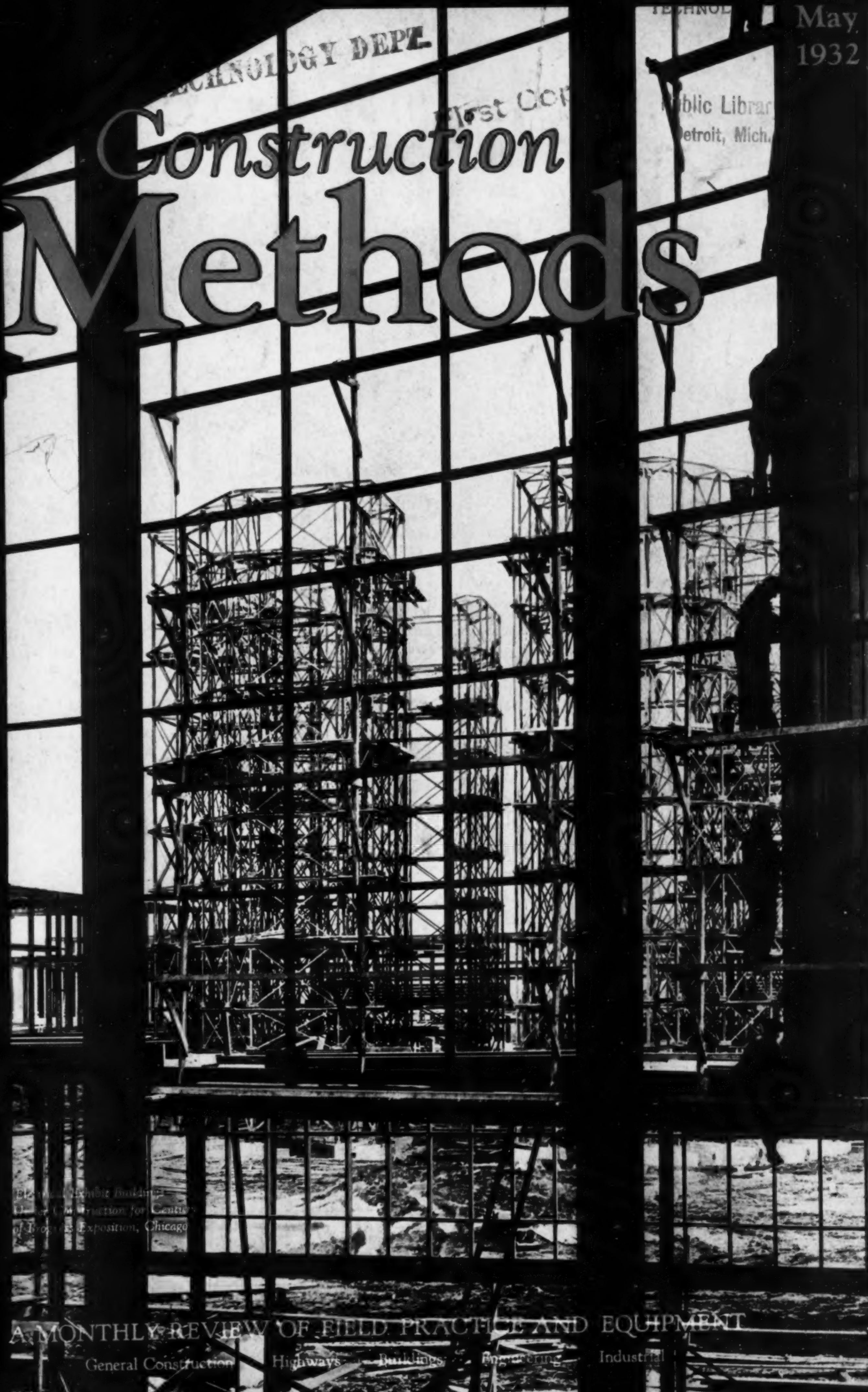
May
1932

Construction Methods



Electrical Exhibit Building Under Construction for Century of Progress Exposition, Chicago

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction — Highways — Buildings — Engineering — Industrial

McGraw-Hill Publishing Company, Inc.

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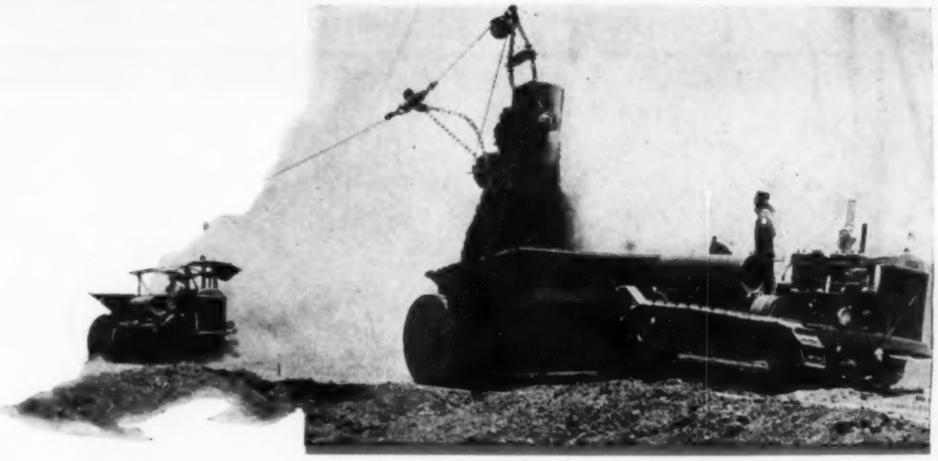
The Editor Notes -



The Human Element in Construction

COL. W. A. STARRETT, whose recent untimely death left vacant the presidency of the Associated General Contractors of America and removed from the field of building construction a figure long and prominently identified with the development of the skyscraper, frequently expressed the belief that success in engineering or construction demanded more than technical skill. In another month our colleges will turn out their yearly quota of embryo engineers and constructors. To these men, beginning work in a great industry, the remarks Col. Starrett made about a year ago, at the Fourth Michigan Engineering Conference, should be stimulating. In the past, he maintained, engineers had failed to become fundamental leaders in the building industry, which they made possible, because they had neglected the human element. He said, in part:

"The ideal leader in the construction industry is a trained engineer with a genius for business, human relations, banking and administration. Such men forge to the front and take their places as capable executives in great building organizations. The engineering graduate might well profit by courses in the development of imagination, in projecting the mind forward to vision accurately the effect of his acts. This interweaves with the even more subtle accomplishment of divining human nature, the probable effect of his manner, conduct, expression and knowledge on those who hold the power of decision. There is a handicap that besets every scientist in the practical application of his subject: The thing he knows is too obvious to him. It grates and jars to introduce any element of contradiction. In building there is nothing so stupifying to the consummation of a great structural project as dominant insistence on scientific perfection * * * in everymove.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

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McGraw-Hill Publishing Company, Inc.
330 West 42d St., New York, N. Y.

"Human relationships play a big part and engineers must adjust to that realization. The need for cultural background is vital, for, after all, one must be *persona grata* to obtain the initial audiences, and nothing counts more than good address. The slide-rule must be made to fit the pocket of a dinner coat if we are to win the opportunity of showing what we can do."

Foremen's Course in Safety

"Safety in Foremanship," based on a course prepared by the National Safety Council, was the theme of a series of seven weekly meetings held recently in Newark, N. J., for construction foremen under the auspices of the Newark Safety Council. Organized by John Russell, Jr., of United Engineers & Constructors, Inc., as the first experiment in this form of education for construction men, the course attracted the unexpectedly large registration of 185 and culminated in the voluntary formation of a foremen's safety club to enlist in the foremen's section of the Newark Safety Council. The purpose of the construction foremen's club is to maintain the associations and continue the discussions originated by the course.

Each meeting was skillfully planned to include a prepared address on a pertinent safety subject by an experienced man, motion pictures of an interesting construction job, and discussion by those in attendance. The sessions were limited to an hour and a half. Careful planning of the course resulted in sustained interest and enthusiasm on the part of the foremen, and the discussions gave evidence that the ideas proposed were falling on receptive ears. Good management and a planned program produced the encouraging result.

In these days of slack business foremen have more time than usual to spend in educating themselves for greater effectiveness on the job. They are ready and eager to attend evening meetings which will make safety a practical job responsibility rather than an abstract virtue. Only one thing is required to make such meetings a success—the speakers must talk plain facts which will arouse interest and provoke discussion.

Yard Layout as a Time Saver

"On a paving job where operations should synchronize and coordinate, minutes lost are dollars wasted."

This is the conclusion of T. C. Thee, assistant highway engineer, U. S. Bureau of Public Roads, based on the results of stop-watch studies of concrete paving operations on several representative contracts. Many contractors fail to realize that a delay of only 1 min., apparently an insignificant item, actually means a loss of 5 cents in the case of a three-batch truck, and about $1 in the case of a paving mixer. Time losses are not always chargeable to inefficient equipment. Often the reason is found in improper layout of plant. This is particularly true in the case of material-handling yards, of which several examples of both good and bad practice are illustrated on pp. 36 and 37. With intelligent planning, yards can be laid out to produce straight-line loading and minimum turning time for the trucks. Haphazard yard layout means lost time—and lost profits.

To Tap the Springs of Progress

ANALYZING the operations of a well-known manufacturer of construction materials, one of the business advisory services recently reported:

> "The general business depression, moreover, is stimulating research and development of new products as well as more economic production and marketing methods."

This statement applies to more than the one company under discussion; it holds also for most of the substantial manufacturers throughout the construction field. Almost all of them are developing, in their research and designing departments, improvements to their present machines and new equipment to perform new functions; they are seeking to produce new materials that will effect greater economies in installation, or that will be more durable or more serviceable in use.

Necessity still is the mother of invention, and adversity still is the goad of industrial progress. Out of our present trial will emerge the new materials, new machines and new methods that will generate the driving power behind our next rise to prosperity.

Engineers, constructors and executives — all who have a stake in the construction industry — owe it to themselves in these days to keep in close touch with the work of the manufacturers who serve their field. It will pay them to follow closely the advertisements in *Construction Methods* and other industrial journals, to scan carefully the descriptive circulars and booklets that come to them in the mail, to welcome the manufacturer's salesmen and to give them a chance to set forth what their house has to offer.

We are living through a period of transition and development that will result in new standards of practice and efficiency in every department of industry. The laboratories, engineering departments and shops of the progressive manufacturers will initiate and foster much of this progress. No one responsible for construction operations can afford to lose his contact with them. So when the manufacturer reaches out to maintain that contact, it is good business for the user of his products to meet him at least halfway.

Willard Chevalier

Publishing Director

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

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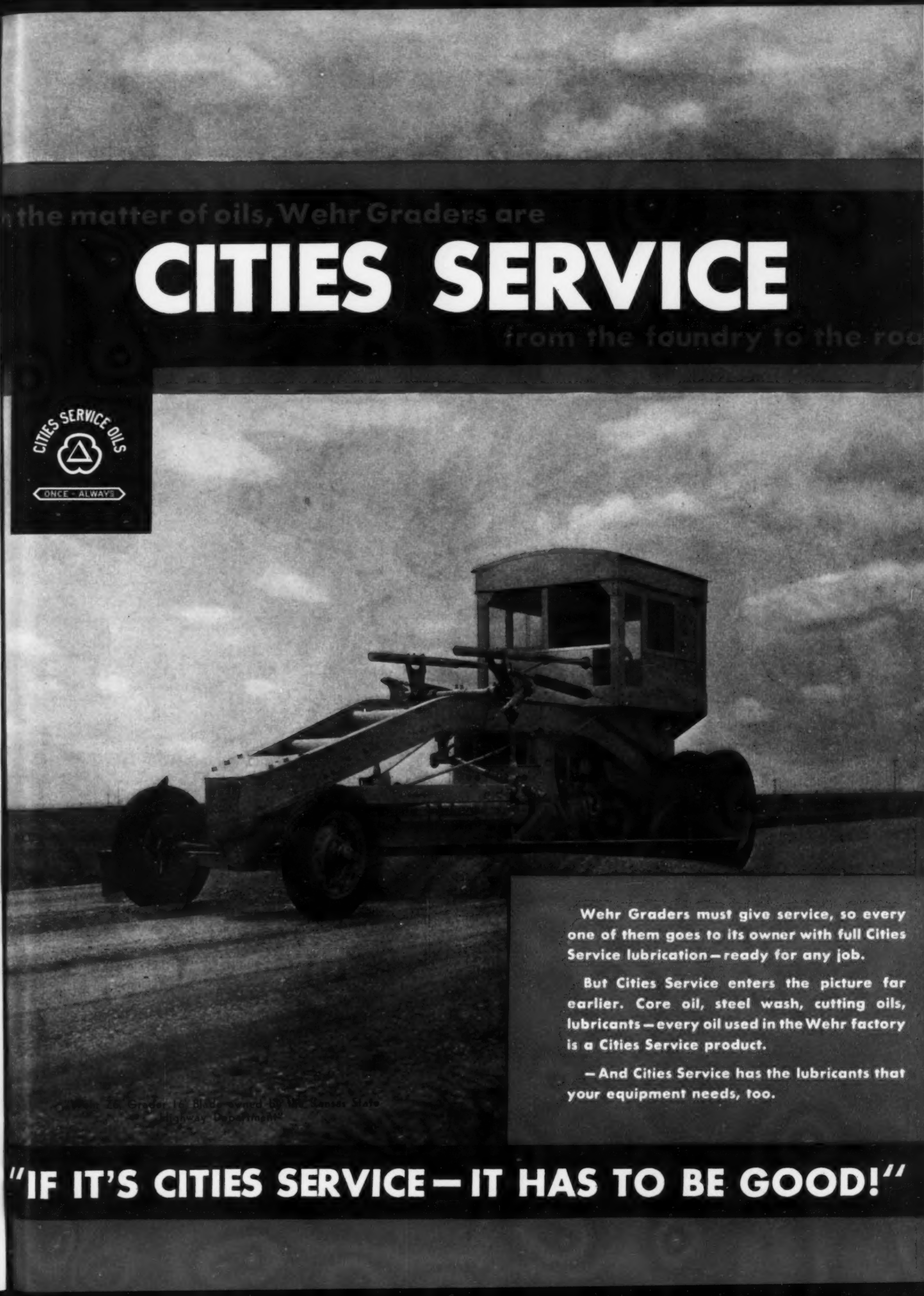
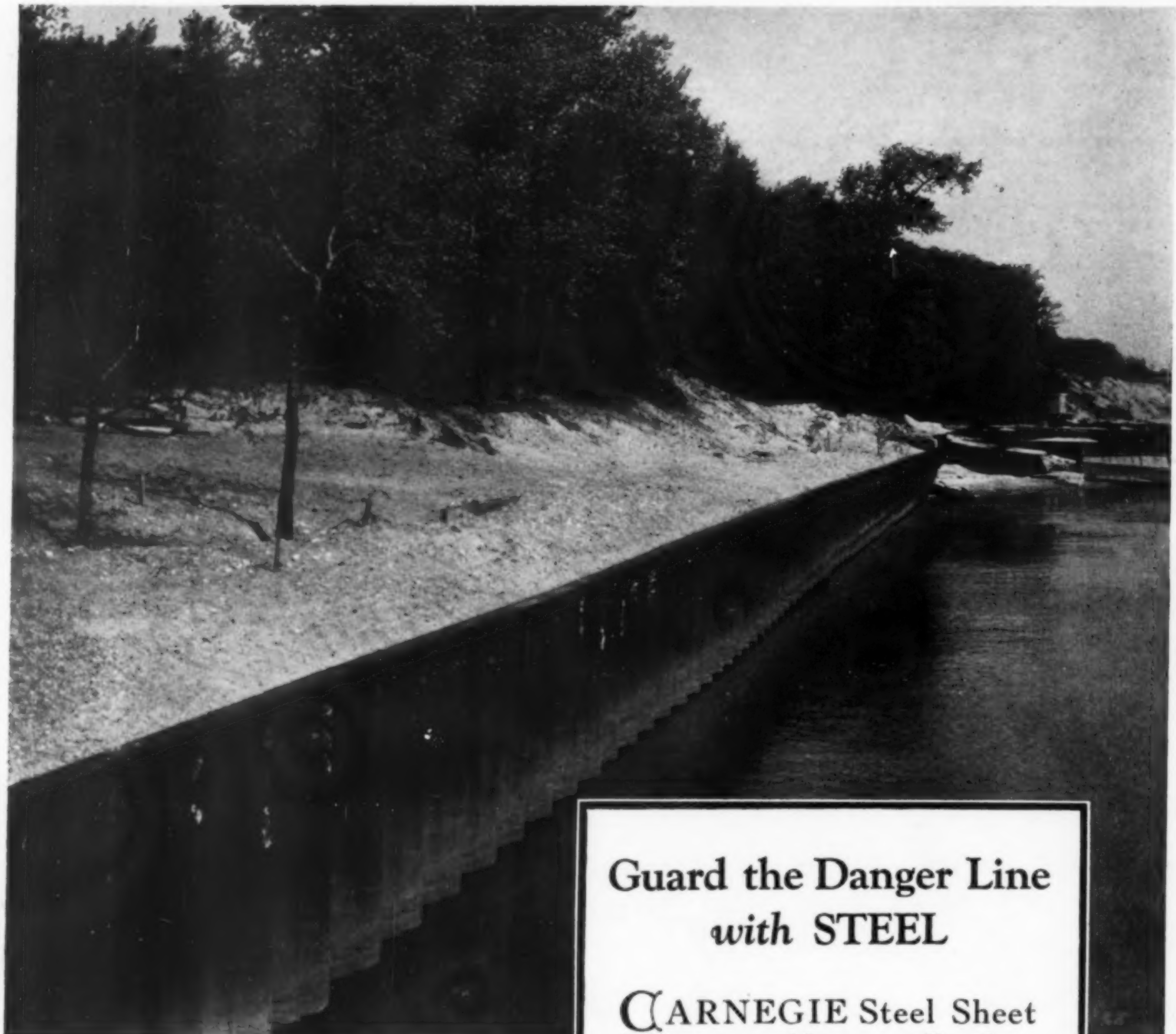

the matter of oils, Wehr Graders are
CITIES SERVICE
from the foundry to the roa
CITIES SERVICE OILS
ONCE - ALWAYS
Wehr Graders must give service, so every one of them goes to its owner with full Cities Service lubrication—ready for any job.
But Cities Service enters the picture far earlier. Core oil, steel wash, cutting oils, lubricants—every oil used in the Wehr factory is a Cities Service product.
—And Cities Service has the lubricants that your equipment needs, too.
"IF IT'S CITIES SERVICE—IT HAS TO BE GOOD!"



Guard the Danger Line *with* STEEL

CARNEGIE Steel Sheet Piling provides an effective, artistic and economical barrier against erosion of the shore. Carnegie engineers welcome the opportunity of discussing your problems with you.

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CARNEGIE STEEL COMPANY
PITTSBURGH, PA.
Subsidiary of United States Steel Corporation

183

CARNEGIE STEEL SHEET PILING

THE FIRST AND ONLY 1 3/4 YARD SHOVEL WITH ALL THESE ADVANTAGES!

An Independent Crowd that gives you 50% increased digging effectiveness of the engine because there is only 15% loss of digging force while thrusting instead of the usual 45% loss present on other types of independent crowd shovels.

Full clutch and brake equipment is furnished for converting to crane, dragline or pullshovel.

A complete inclosure that protects the operator from bad weather is standard equipment.

More than ever the "feather-touch" clutch control speeds operation by relieving the operator of the work of shifting heavier clutches. The "feather-touch" clutch control retains the "feel" of the load and does not drag on the drum

Ball and roller bearings introduced to the shovel industry by Northwest are used on all high speed shafts in accordance with good engineering practice.

Powerful, slow speed, heavy duty engine.

Helical gears mounted on ball and roller bearings and running immersed in oil (the practice employed in the finest speed reducers) deliver the power from the engine.

Can be loaded on a standard flat car under its own power without dismantling.

For the first time you can have a shovel in the large capacity class that gives you the unequalled mobility that comes with positive traction on both crawlers while turning as well as while going straight ahead.

NORTHWEST SHOVEL— AMERICA'S LEADING ROAD BUILDE

Never before have these features been incorporated in a shovel of this capacity!

Here are exclusive advantages that add speed to operation and forecast a potential output equal to that of much larger and costlier machines.

NORTHWEST ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1728 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Ill., U. S. A.

CM 5 Gray

NORTHWEST

THE ALL PURPOSE SHOVEL CRANE DRAGLINE

SOUNDNESS of basic design and the through-and-through good quality of the Link-Belt shovel-crane-dragline, are responsible for its unusual ability to do a lot of work under severe conditions.

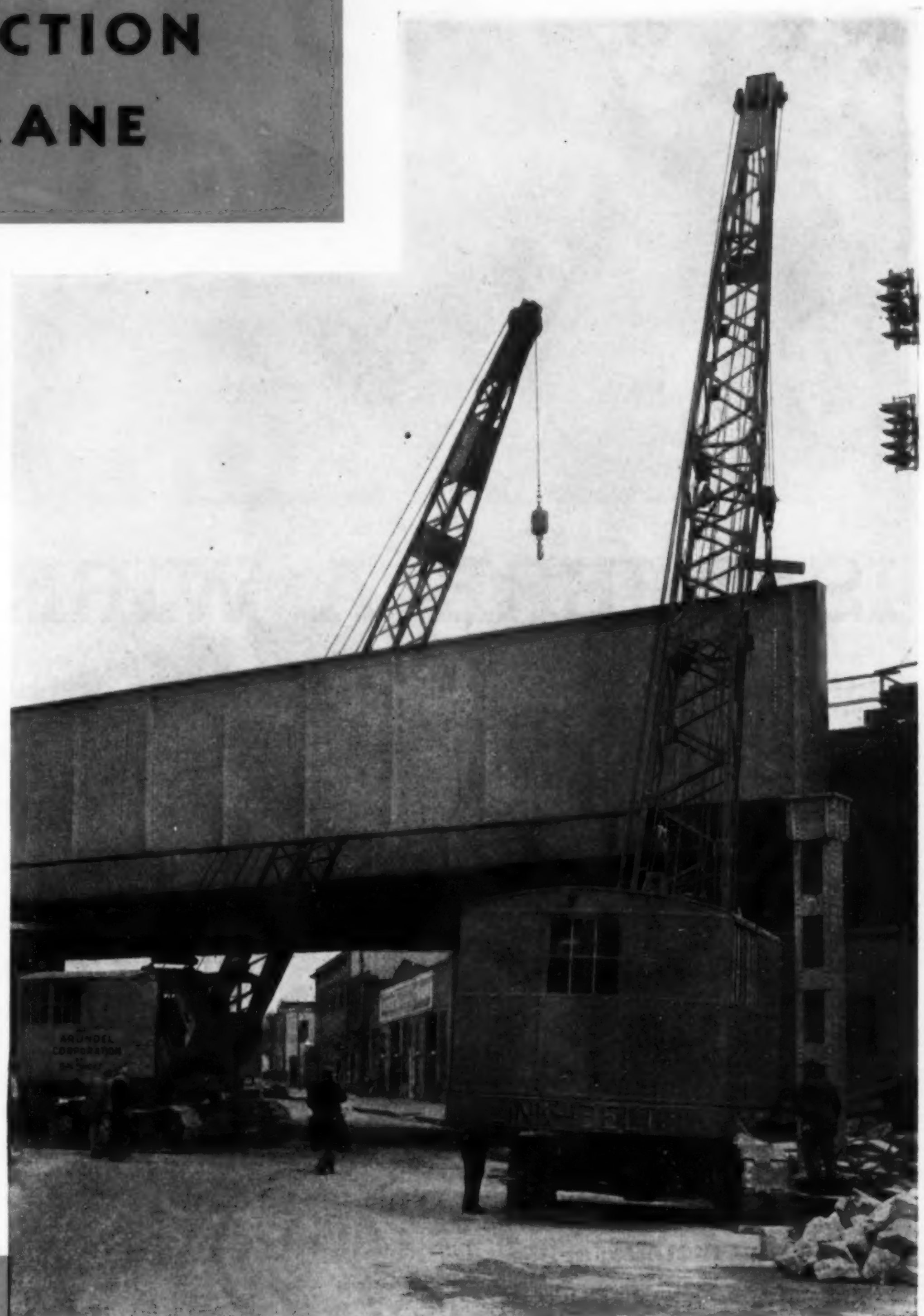
It is "heavy-duty" built, to meet all conditions, and not around a few features. Not range or capacity alone, nor power, nor ruggedness, nor stability—but rather an ideal combination of all—balanced and uniform, is represented in the design of the Link-Belt Shovel-Crane-Dragline.

The range of sizes is up to 2 ½ yds. capacity, Gasoline, Diesel or Electric operated. Any model can be shipped on a flat car without dismantling.

LINK-BELT
300 W. Pershing Rd., Chicago

LINK-BELT

THE ACCEPTED ERECTION CRANE



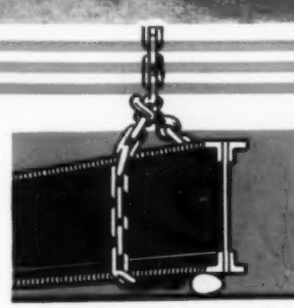
THE stability and perfect mechanical control of the Link-Belt, makes steel erection, stone setting, and other work of this nature, a simple, safe and easy task.

The operator of a Link-Belt can FEEL every movement—absolute control is in his hands. The large, powerful clutches and brakes are instantly responsive to the slightest movement of the operating lever. Engagement and disengagement respond so perfectly to the lever, that safe, easy and fast handling of heavy loads, even with long booms, is accomplished with smoothness and exactness. Clear vision is had by the operator on all sides—no blind spots and hazardous guessing.

COMPANY
Offices in Principal Cities

4527

SHOVEL • CRANE • DRAGLINE •



CONTROL

The Link-Belt responds with such smoothness of motion and accuracy of control, that some operators claim they could lower a heavy load accurately enough to come to rest upon an egg without breaking it.

CURE-ALL?

no one type or construction of wire rope is suitable for all purposes—that there is no wire rope "cure-all".

You will find, therefore, that Roebling does not favor any one kind of rope. It endeavors to, and because of its complete line, is free to recommend exactly the rope that most economically and fully will meet the user's needs.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON NEW JERSEY
Branches in Principal Cities *Export Dept.: New York*

WIRE · WIRE ROPE · WELDING WIRE · FLAT WIRE · COPPER AND INSULATED WIRES AND CABLES · WIRE CLOTH AND WIRE NETTING

A plain statement about Wire Rope Economy

Roebling does not indulge in nor encourage sweeping claims of superior wire rope economy. Such claims, if generally made, would merely confuse the rope user.

For the guidance of rope buyers, however, Roebling does assert that *when gauged by the work performed, NO wire rope,* regardless of make or construction, *will show lower general average operating costs than Roebling.*

Wire Rope for all purposes

There is no such thing as a wire rope "cure-all". No *one* design of wire rope is suitable for *all* purposes.

Roebling makes wire rope of a great variety of types and constructions, and therefore can supply a wire rope exactly suited to each particular requirement.

The great stamina of all Roebling Ropes is primarily due to the *quality* of Roebling Wire. This Acid Steel Wire is renowned for its fatigue and wearing qualities. No better rope wire is produced.

"BLUE CENTER" STEEL is the highest grade and is generally recommended for severe duty.

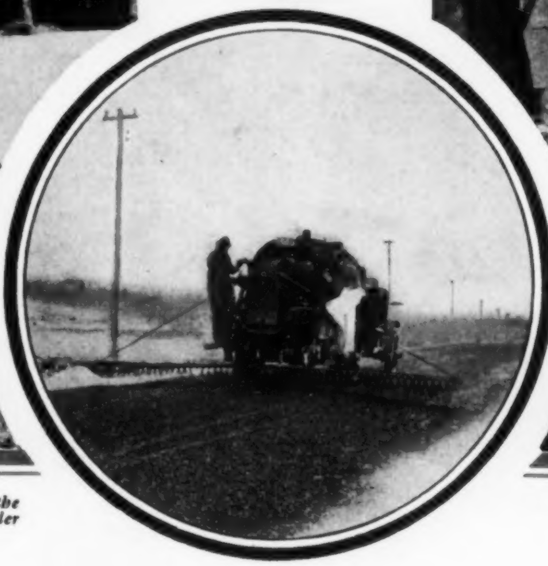

LORAIN 75B


TOP TO BOTTOM
Digging down into Brooklyn subsoil two Thew Lorain 55 shovels, owned by Marcus Contracting Co., moved 300,000 yards of dirt to open the path for a subway along Marcy and Lafayette Avenues. The performance of the 1-yd. Center Drive machines was so completely satisfying that the two 1¼ yard Lorain 75's, shown here, have since been purchased by the same firm. The Thew Shovel Co., Lorain, Ohio.
THEW LORAIN
MARCUS CONTRACTING CO.

COLAS

REG. TRADE MARK

Native labor applying COLAS in the tropics. Colas Roads do not bleed under the hottest sun.



Economical COLAS repair work in Bangor, Maine

Builds roads *from* Africa *to* Maine

NEITHER the heat of the tropics nor the rigors of a New England winter affect Colas Roads. A Colas Road stays in perfect condition at ALL temperatures—beneath the blistering sun of Africa, India, Australia, or the zero temperatures of Northern Maine. Colas Roads are in use in all the principal countries of the world—ONE proof of the economy of this method of road construction.

COLAS enables a high quality asphalt binder to be perfectly applied COLD. It is an emulsion of pure petroleum asphalt.

Colas provides maximum penetration and bond with the use of a minimum of asphalt. Thus all tendency toward bleeding and skidding and tracking is eliminated. Traffic may safely use a Colas Road immediately after it is laid.

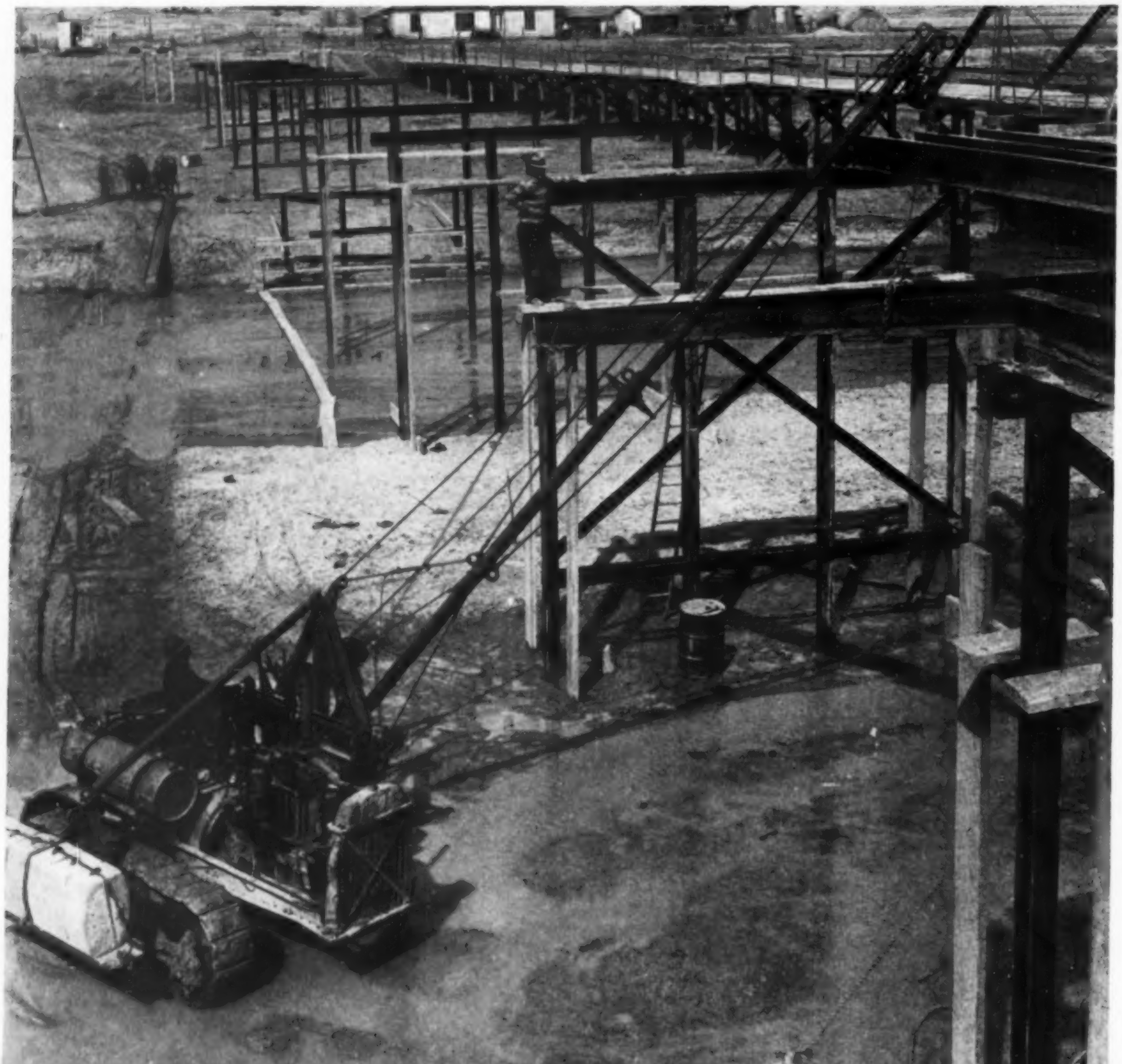
AND Colas service goes with every Colas shipment. Colas Engineers are available for consultation everywhere without any obligation on your part. There are nine Colas factories in North America; others are projected. More than 85 factories throughout the world are required to supply the universal demand for COLAS—the ideal method and material for YOUR road work.

SHELL OIL COMPANY • San Francisco

SHELL PETROLEUM CORPORATION • St. Louis

SHELL EASTERN PETROLEUM PRODUCTS, INC. • New York City

Licensees of Colas Roads, Inc., New York City



Builds Bridges, too!

A "CATERPILLAR" Sixty, equipped with winch and boom, did most of the work in building this bridge near Boulder, Colorado. It took 19 days to finish the job—the "Caterpillar" drove the piles and hoisted the last beam into place. Road builders are discovering that "Caterpillar" track-type Tractors "go anywhere and do most everything!"

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.
Track-type Tractors   Combines   Road Machinery
(There's a "Caterpillar" Dealer Near You)

Prices—f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

CATERPILLAR
REG. U. S. PAT. OFF.
T R A C T O R

Construction Methods

ESTABLISHED 1919—MCGRAW-HILL PUBLISHING COMPANY, INC.

ROBERT K. TOMLIN, *Editor*

VOLUME 14 NEW YORK, MAY, 1932 NUMBER 5

ELEVATED RUNWAY carries concrete truck over bridge roadway deck.

ST. JOHNS BRIDGE has cable suspension main span of 1,207 ft.

TRUCK ON RAISED RUNWAY

Chutes Concrete to Bridge Roadway

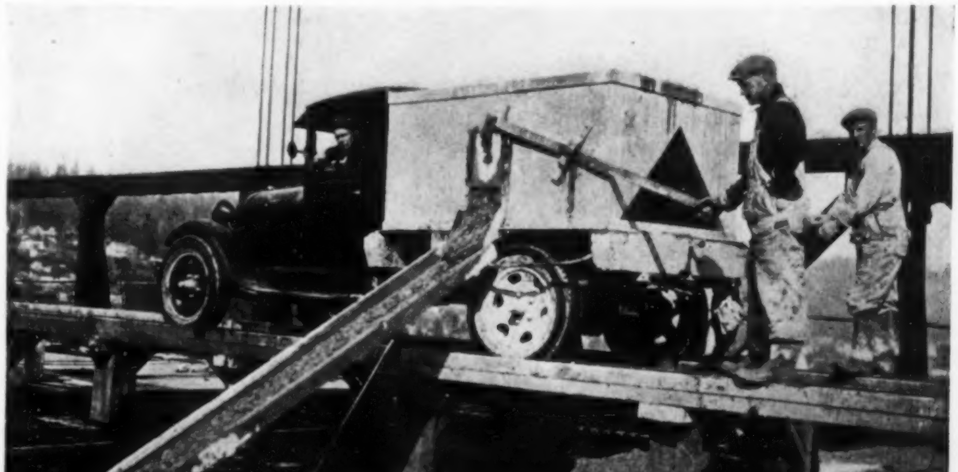
FOR pouring the 40-ft. slab forming the roadway deck of the St. Johns suspension bridge across the Willamette River at Portland, Ore. (described in the February number of *Construction Methods,* p. 20) Lindstrom & Feigenson, contractors, used transit-mixed concrete delivered to hoppers at each end of the structure and thence carried to place by a 2-ton Ford truck equipped with a 1-yd. body divided longitudinally into two compartments to permit chuting from both sides simultaneously.

The roadway slab, divided into four 10-ft. traffic lanes by metallic disk markers set into the concrete at 6-ft. intervals, is 7 in. thick and is reinforced with ½-in. steel bars spaced 3 in. on centers at the bottom and 6 in. on centers at the top of the slab. The concrete is a 1:5 mix containing 6.8 sacks of cement per cubic yard and 4.95 gal. of water per sack of cement, meeting the specified requirements of a minimum 28-day strength of 3,200 lb. per square inch.

As illustrated in the accompanying photographs, the Ford truck, with its divided-hopper body, operated upon an elevated wooden runway erected along the center line of the bridge. Through gates in each side of the truck hopper concrete flowed to place through inclined chutes, the elevation afforded by the raised runway being sufficient to insure a gravity discharge to the edges of the 40-ft. roadway.

The roadway of the main span of the bridge was poured in panels 38½ ft. long, the pours being distributed along the span according to a pre-determined schedule to prevent excessive tower and truss deflection.

The St. Johns bridge was designed by Robinson & Steinman, consulting engineers, of New York, for whom R. Boblow served as resident engineer.



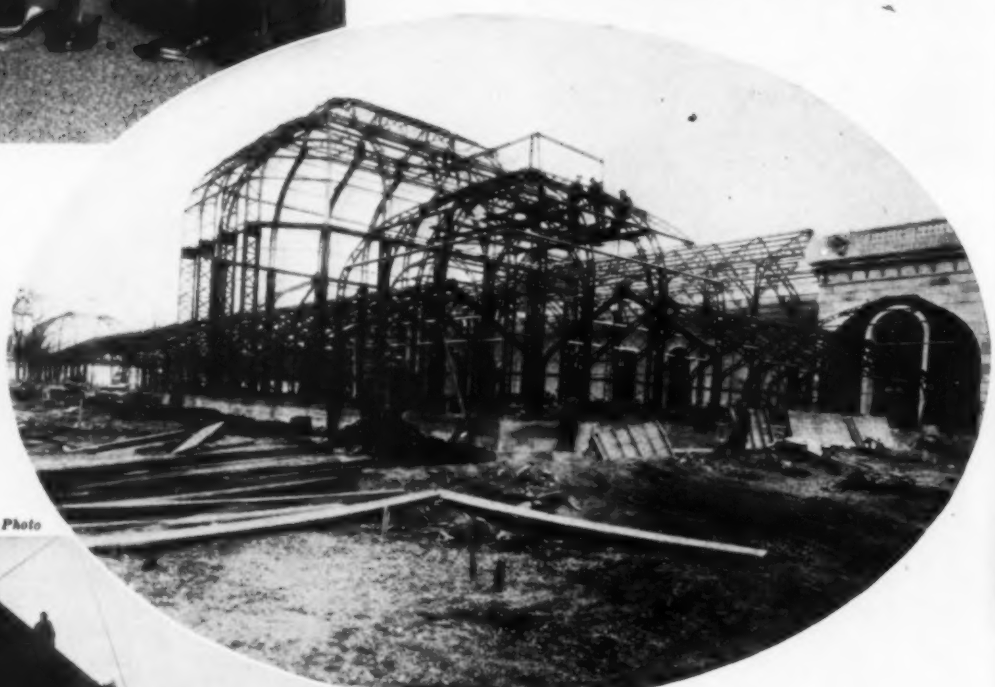
DIVIDED COMPARTMENT on truck body allows concrete to be chuted to place from either side.

This Month's "News Reel"

SAFETY TROPHY for building trades awarded. CHARLES S. WILLS, president of Charles T. Wills, Inc., general contractor of New York, receives A. E. Davidson cup from F. A. Davidson, one of its donors, in recognition of best accident prevention record in 1931. *(Left to right)* Mr. Davidson, Mr. Wills, Henry W. Lohman, vice-president, James Stewart & Co., Inc., chairman of Committee on Accident Prevention of the N. Y. Building Trades Employers Association and J. George Costello, of Costello Construction Co., vice-chairman.

Wide World Photo

ALUMINUM CANTILEVER ROOF TRUSSES *(below)* form dome of new conservatory built by George A. Fuller Co., general contractor, of New York, for U. S. Botanic Garden at Washington, D. C. Building is a hollow rectangle, 284x183 ft. in plan, costing $625,000. For structural members aluminum alloy was adopted to reduce cost of maintenance, cleaning and painting, especially in lofty portions difficult of access and subject to moist atmospheric conditions. Weight of aluminum is about one-third that of steel.



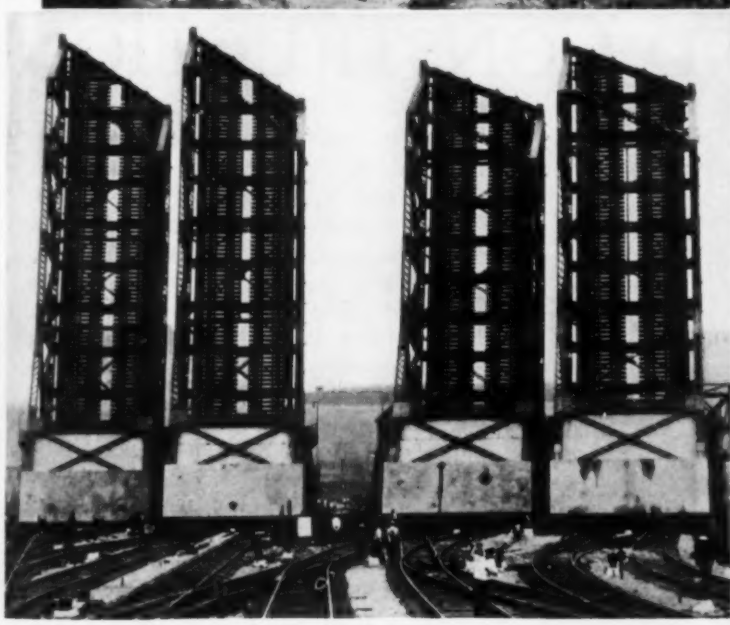
HUGE TRUSS *(left)* for one of Radio City buildings, New York. Weighing 260 tons this structural unit, erected by Post & McCord to carry proscenium of International Music Hall in 70-story building at Rockefeller Center, has span of 110 ft. and depth of 36 ft. Seating capacity of theatre will be 6,100 persons. John Lowry, Inc., is the general contractor for the building.

WESTINGHOUSE BRIDGE, at Pittsburgh, completed by Booth & Flinn Co. Five-arch, high-level structure has central span of 460 ft. between pier centers, longest in U. S.

International Photo

HOLED THROUGH (*below*). Mayor Walker, of New York *(left)* and Patrick McGovern, contractor, officiate at meeting of last headings on $43,000,000 aqueduct tunnel, 20 mi. long.

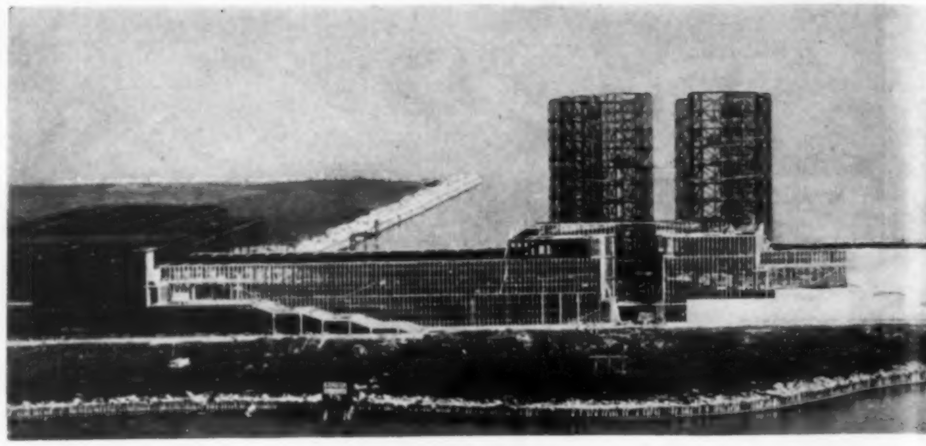
Acme Photo



QUADRUPLE CROSSING. Four double-track rolling lift bridges over Charles River at Boston, Mass., completed recently for Boston & Maine Railroad by Pheonix Bridge Co.

UNEMPLOYMENT RELIEF (*right*). An extensive program of winter bridge construction has been carried on by the Ohio State Highway Department. A total of 349 bridge contracts was awarded between Dec. 8, 1931 and Jan. 22, 1932 to provide jobs for construction workers. Bridge illustrated is 60-ft. span concrete beam structure on Baltimore-Fostoria road. Concrete is covered and heated during curing period.

PLANNED primarily to function efficiently as housing units for Chicago's second World's Fair, the buildings of A Century of Progress are designed also to satisfy the four-fold requirement of structural soundness, economy, good appearance, and speedy razing after the close of the exposition. As a condition of obtaining a lakeshore park site near the Loop district for the exposition, the directors agreed to remove all structures within twelve months following the end of the fair. The buildings are of unconventional, unsymmetrical design with exterior treatment mainly in the modern style peculiarly adapted to the economical materials utilized. They are distinguished by the general use of two and three levels, instead of one, by the extensive use of wide ramps or easy stairways leading from level to level, and by the absence of windows. Practically no glass is employed in the exterior walls except for display windows along walks and terraces. The architectural commission chose uniform artificial illumination as more desirable than variable natural light.

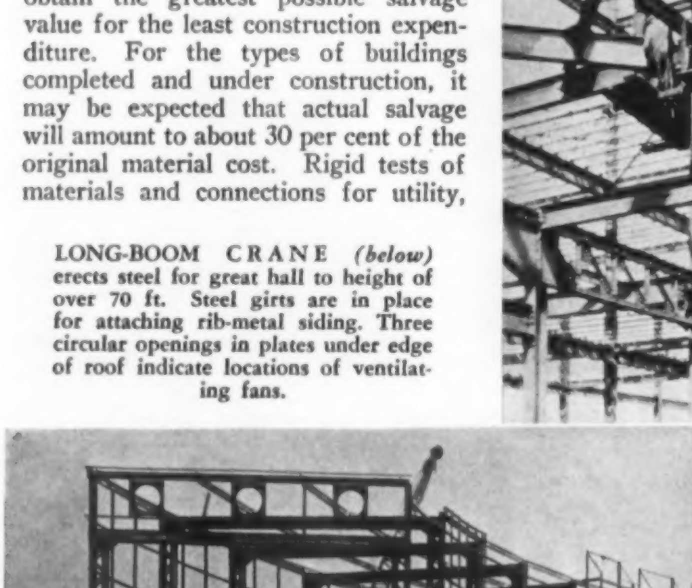


ELECTRICAL GROUP has steel-sheet and gypsum-board exterior cover on side- vertically, inclose semicircular great hall at right. Rest of siding is Sheetrock joints. Reinforced-concrete stairs rise from ground to first floor terraces at several left center, 100 ft. high,

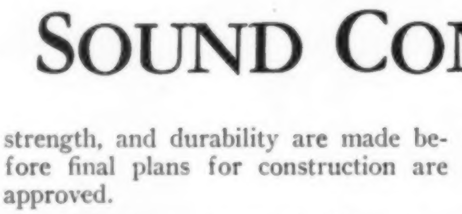
Chicago Exposition
SOUND CONSTRUCTION

Salvage Value—Although salvage is given no value in judging the economy of various designs, the determination being made solely on the basis of first cost, the structural engineers of the Department of Works do attempt to obtain the greatest possible salvage value for the least construction expenditure. For the types of buildings completed and under construction, it may be expected that actual salvage will amount to about 30 per cent of the original material cost. Rigid tests of materials and connections for utility, strength, and durability are made before final plans for construction are approved.

LONG-BOOM CRANE *(below)* erects steel for great hall to height of over 70 ft. Steel girts are in place for attaching rib-metal siding. Three circular openings in plates under edge of roof indicate locations of ventilating fans.



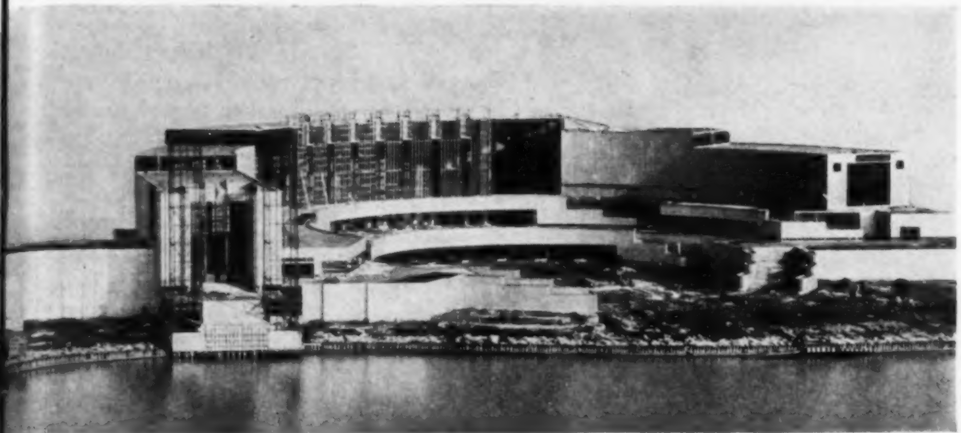
Foundations—All the buildings are erected on made land which has been built up in part by dumping scow-loads of dredged material, largely clay, and truck-loads of clay and debris from foundation excavations in the city and by pumping in lake sand excavated and transported to the city by hopper dredges. Below the old lake bottom is a layer of soft silt-like clay approximately 35 ft. deep. Long piles, therefore, are necessary to support loads, and all buildings of A Century of Progress are carried by wood piles 60 to 75 ft. long. Test piles are driven to determine the load capacity of various lengths. The maximum average penetration permitted on the last blows allowed is 1 in. per blow, which provides a maximum load capacity of 20,000 lb., the maximum penetration for larger loads being determined by the Engineering News formula.



RIVETED FIELD CONNECTIONS are used only in wind brackets, towers, large halls, and cantilever construction. Most connections are bolted for easy demolition.

Typical buildings, which are two stories high, have two piles under each interior column and one pile under each exterior column. The piles are capped with reinforced-concrete. Piles under interior columns are lined up in the weak direction of the columns, the strong direction of the columns being calculated to take the eccentricity of the piling. The strong direction of the exterior columns is placed at right angles with the building wall, and the pile cappings are tied together at grade by beams to resist the eccentricity of the piling in the weak direction of the columns and to support the wall. On all buildings so far constructed, these beams have been reinforced concrete. Hereafter, they will be wood, which is lower in first cost and easier to remove.

Steel Frame—The principal structure of the buildings is required to be



walls. Ferrobord copper-bearing 20-gage interlocking ribbed steel strips, applied gypsum board primed with aluminum paint and set with waterproofed, battened points. In front of great hall are terraces at two levels. Tall steel framework at was erected in three tiers.

Buildings Exemplify FOR SHORT SERVICE

strong, well-braced and incombustible. It is made up of standard structural steel sections with shop connections riveted. For ease of demolition, all field connections are bolted except wind-bracing connections on large halls and towers and all cantilever construction, where riveting is employed. In general, bays are 20 ft. long in the direction of the floor joists and are of any desired width, long spans being employed as much as possible to reduce piling and foundation costs.

Secondary Framework—For the framework of the wall, combustible material is permitted, and the designing engineers have standardized on wood plates and studding. The framework is attached to the steel frame for stiffness by bolting the plates to the outside beams. The studding, which rests on the outside foundation beam, is thoroughly secured to the plates. Studs are 2x6 in. pieces spaced 24 in. on centers for story heights up to 16 ft. This spacing is sufficient for wind resistance and fits the size of wallboard panels used.

Wall Covering—It is required that the inside wall covering be incombustible. Gypsum wall board, $\frac{3}{8}$ in. thick, 4 ft. wide, and 8, 10, or 12 ft. in length, is used for the inside covering. Gypsum board $\frac{1}{2}$ in. thick also has been used extensively for the exterior covering, although combustible material is permitted on the outside. When applied to the outside of the wall, the gypsum boards, ordinarily 4 ft. wide and 8 to 12 ft. long, are erected with the length horizontal, with V-type tongue-and-groove horizontal joints, laid to weather, and vertical butt joints. All joints are set in mastic. Gypsum wall board for exterior use is primed on all sides at the mill with a coat of aluminum paint.

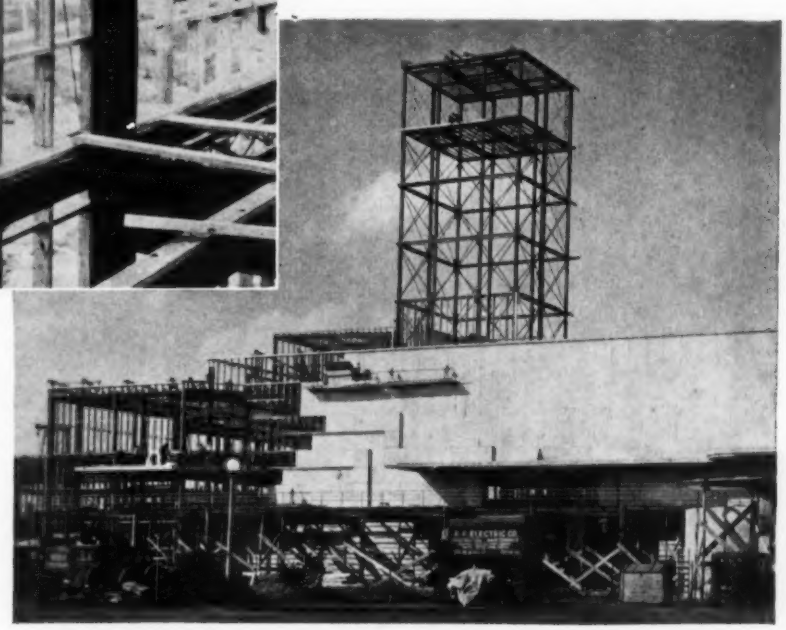
Five-ply Douglas fir plywood $\frac{1}{2}$ in. thick, impregnated with hot linseed oil at the plant before shipment, has also been employed for the exterior wall covering. Plywood for this purpose comes in sheets typically 4 ft. wide and 8 ft. long. They are applied with lengths vertical or horizontal and with horizontal and vertical lap joints laid to weather and waterproofed with mastic.

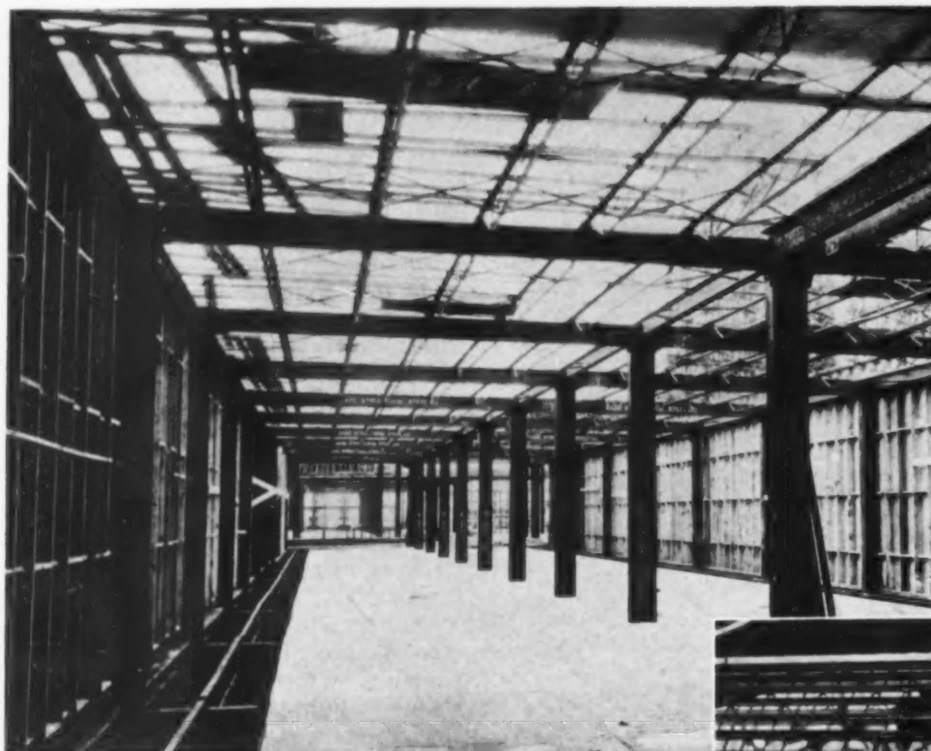
On both gypsum and plywood surfaces, the vertical joints are battened, with metal if a flat surface is desired and with wood if the architect wishes to make the batten prominent. Horizontal joints are battened only for decorative purposes. The back of all battens is covered with mastic prior to nailing. All wall covering is detailed and cut to exact size to fit design patterns, utilizing typical sizes as far as practicable.

On the first exhibition building erected, the Travel and Transport Building, a metal wall covering consisting of light-gage, cold-rolled ribbed steel sheets was used for the exterior. The rib-steel siding was applied vertically and was clipped to steel girts spaced not over 8 ft., c. to. c. This type of siding still is used for design effects, as illustrated on the semicircular hall of the Electrical Group. On large halls, which rise to clear heights of 20 to 70 ft., steel girts are used to transmit the wind load to the columns.

Floor and Roof Joists—Open-web steel truss joists offered the most eco-

SECONDARY WALL FRAMING consists of wood studs resting on foundation beam and secured to wood plates which are bolted to steel frame. PLYWOOD EXTERIOR WALL COVERING *(below)* is nailed to studding of Hall of Science by workmen on suspended scaffold. Sheets, applied with length vertical, have lap joints which are sealed with mastic and battened.





TYPICAL CONSTRUCTION of exposition building, with wood studding, open-truss joists braced by stiff bridging, and plywood decking for floor and roof. GUSTAVE EEN *(in circle, below)*, general foreman on Electrical Group for W. E. O'Neil Construction Co., and M. G. LAIGLE, superintendent for A Century of Progress.

nomical means of supporting floor and roof decking. The open-web joists provide space for the collection and passage of air which is expelled from the building by fans. In nearly all cases, the joists are 20 ft. long; the spacing on the floors is 24 in. and on the roofs varies up to a maximum of 40 in. for 20-ft. spans. Stiff bridging, spaced at intervals not exceeding 7 ft., insures the rigidity of the truss-joist construction.

The joists rest on the upper flanges of the steel floor beams, to which they are locked by special bolted metal clamps to assure full bearing on the beam flange. Shims are placed under the ends of the joists as required to obtain uniform levels. A steel I-beam is always used between columns parallel with the joists to stiffen the frame and carry part of the floor load.

Roof—The roofs have a slight pitch. Roof decking is either the rib-metal type of light, cold-rolled, interlocking steel sheets or $\frac{5}{8}$-in. plywood, impregnated with linseed oil, in 3x8-ft. sheets. The plywood is butt-jointed over the joists and has tongue-and-groove joints in the transverse direction. Both types of decking are covered with fiber insulating board, 1-in. thickness being used on the steel and $\frac{1}{2}$-in. on plywood.

BOLTED CLAMP locks open-web joist to upper flange of I-beam, pulling joist into full bearing on beam and holding it rigidily in position.

The waterproof surface consists of three plies of 15-lb. asphalt composition roofing with a tar-gravel top. Flashing and coping are galvanized metal or impregnated canvas.

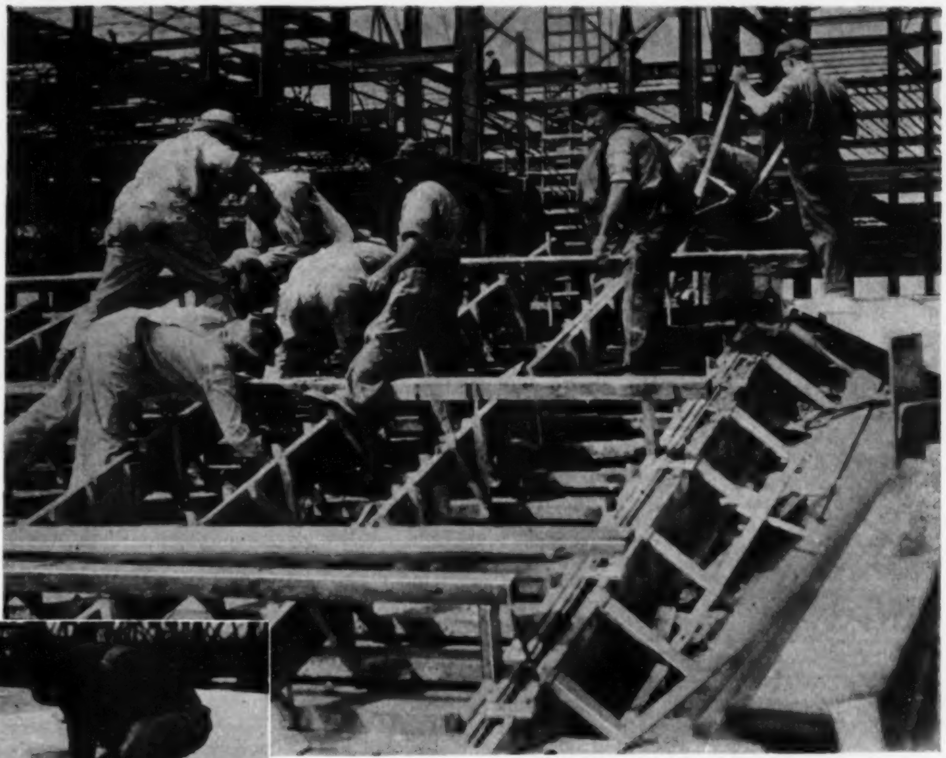
Terraces—Numerous terraces about the buildings are decked with plywood

TERRACE DECK is waterproofed with three-ply built-up roofing.

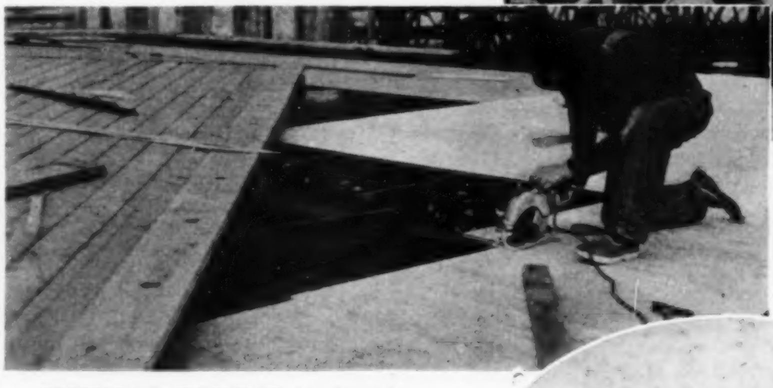
ASPHALT PLANK in 12x24-in. slabs is laid on built-up roofing on terrace.

similar to that used on the roofs. As pitch cannot be mopped directly on the plywood, the decking is covered first with red rosin building paper.

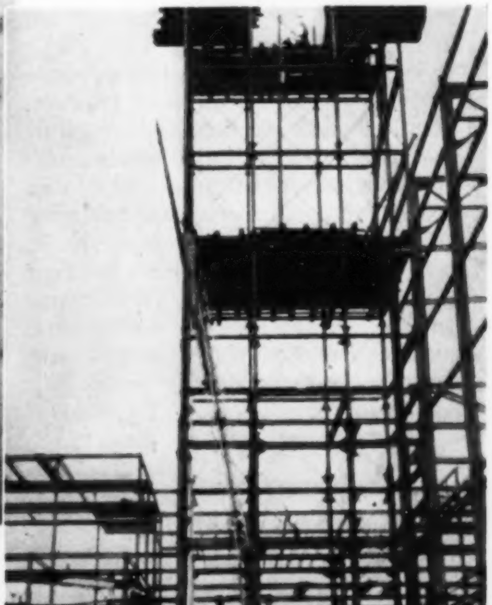
Administration—For A Century of Progress, D. H. Burnham is director of works; C. W. Farrier is assistant director; Louis Skidmore is chief of design; N. A. Owings is development supervisor; B. M. Thorud is structural engineer; and J. R. Hall is general superintendent. The accompanying photographs illustrate the construction of the Electrical Group and of the Hall of Science, the latter now practically completed. On the Electrical Group, for which the W. E. O'Neil Construction Co., of Chicago, is contractor, M. G. Laigle is superintendent for A Century of Progress and J. S. Wilson is contractor's superintendent. The McLennan Construction Co., of Chicago, holds the contract for the Hall of Science, on which G. A. Lindburg is superintendent for A Century of Progress, and Otto Kretzer and P. J. Montague represent the contractor.



POURING CONCRETE in forms for outside stairs. These stairways rest on concrete pile caps and concrete beams. In future, such stairs will be constructed of wood.

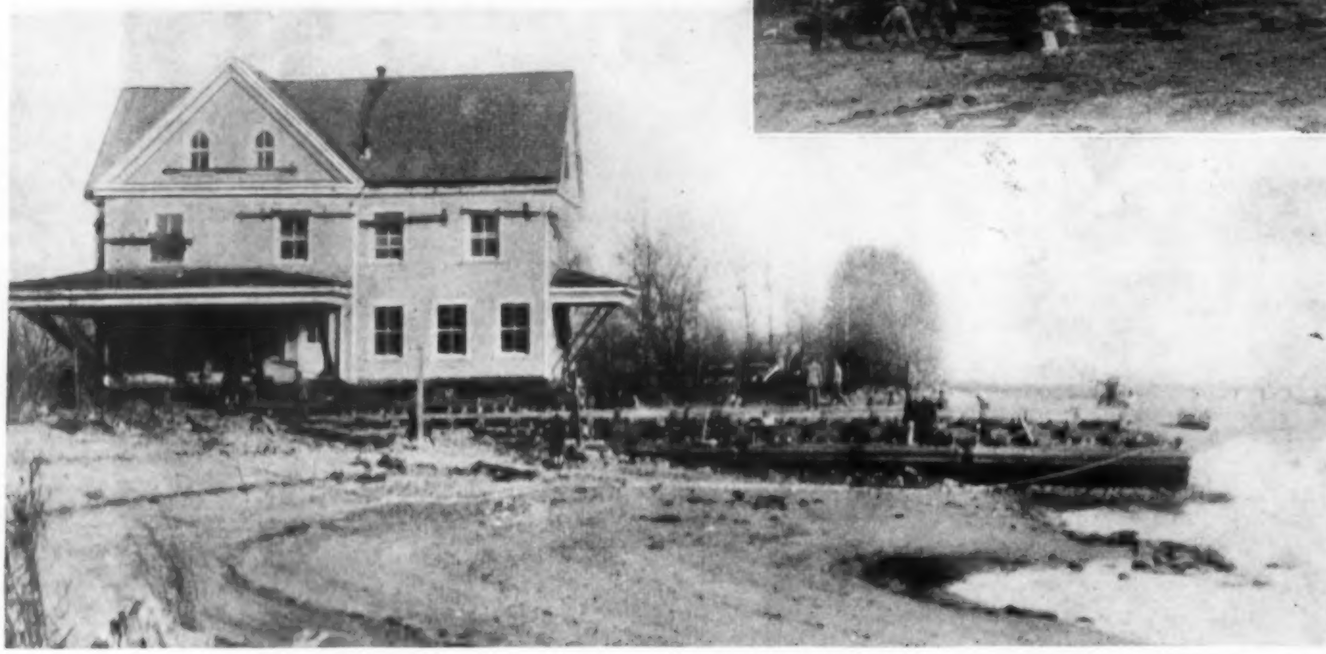


PLYWOOD DECKING is adapted to easy fitting and rapid handling. Power saws speed cutting. At left is roof deck of interlocking steel sheets.



P. J. MONTAGUE ***(left)***, superintendent on Hall of Science for McLennan Construction Co., and G. A. LINDBURG, superintendent for A Century of Progress. **RIBBED STEEL STRIPS** ***(left)*** 6 in. wide are attached to I-beam girts of great hall, Electrical Group, by bolted clips which hold ribs of adjacent sheets tightly together. Crane ***(right)*** with boom lengthened to 100 ft. hoists steel to gin pole erecting 152-ft. Hall of Science tower.

Army Post Buildings MOVED ACROSS RIVER



LOADING BUILDING upon barges backed into channel cut in river bank at Ft. Mott, N. J. TIMBER CRIBBING *(insert, above)* carries structure after being jacked up from its foundation.

By CAPT. F. H. KOHLOSS
Corps of Engineers, U. S. Army, Fort DuPont, Del.

THE 1st U. S. Engineers, since being stationed at Fort DuPont, Del., had a constant shortage of quarters for officers and noncommissioned officers. In June, 1931, the regiment initiated a project for moving eight buildings from Fort Mott, N. J., across the Delaware River to Fort DuPont. These buildings are of frame construction, built about 1902, and have been unused since the post was vacated nine years ago.

The building selected for the first operation was approximately 50x50 ft. square, 3-story, 13-rooms, and weighed about 120 tons. It was situated 1,200 ft. from the water. The plan for moving the building, as carried out, is described below.

After tying the four walls together with ½-in. cable, which helped support the porch roofs, the building was jacked up from its foundation and a timber chassis, with three runners, made of 12x12-in. lumber, was introduced under the base. Three 12x12-in. timber tracks were cribbed up to provide for moving the chassis on rollers.

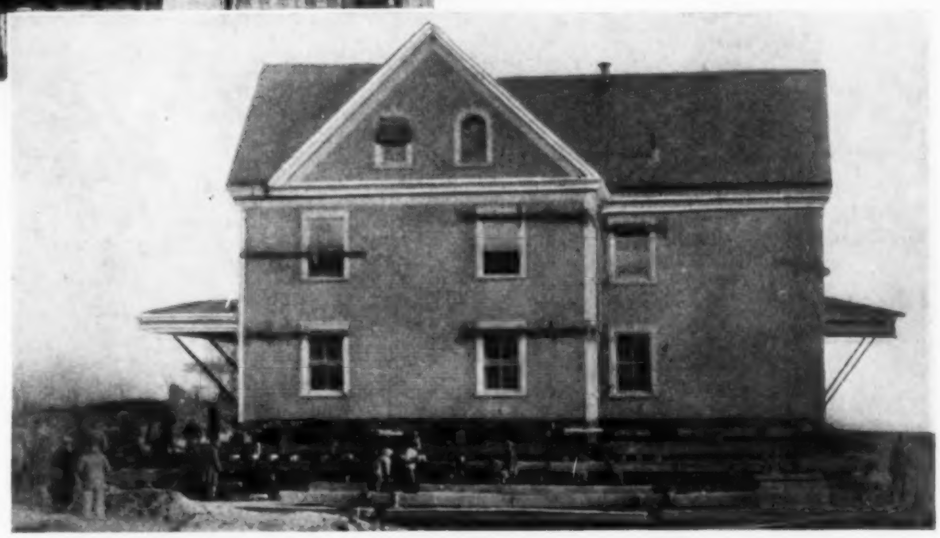
The next phase of the operation in-

ROUTE *(above)* taken by building in barge trip across Delaware River from New Jersey to Delaware.

ARMY MULES hauling slip scrapers excavated basin for landing barges on Ft. Mott beach.

TRUCK CRANE equipped with clamshell bucket excavates barge basin at Ft. Du Pont.

AFLOAT on barges, building passes Delaware City after its trip across river from Ft. Mott on New Jersey side.



TIMBER CHASSIS carries structure while walls are tied together by ½-in. cable extending through windows.

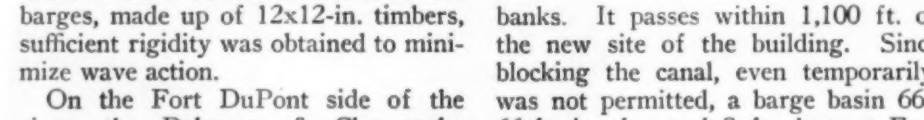
volved the excavation of a barge basin on the Fort Mott sand beach for landing the barges on which the building crossed the Delaware River. This work was done with army mules, slip scrapers, and picks and shovels. The looseness of the sand at this place necessitated extensive sand bag revetting to prevent tidal action from filling up the basin.

A government truck, equipped with a Mead-Morrison winch, pulled the building along the timber tracks on to three barges, each of 60 tons capacity. With a truss across the decks of the barges, made up of 12x12-in. timbers, sufficient rigidity was obtained to minimize wave action.

On the Fort DuPont side of the river, the Delaware & Chesapeake Canal has a 60-ft. channel with steep banks. It passes within 1,100 ft. of the new site of the building. Since blocking the canal, even temporarily, was not permitted, a barge basin 66x 66-ft. in plan and 9 ft. deep at Fort DuPont had to be excavated to permit the barges to float in on a 5-ft. tide and to ground at the proper elevation for unloading the building at low tide. The regimental crane, a Universal 6-ton unit mounted on a 1918 Mack truck, was assigned to the job of excavating the barge basin. Because of the extreme width and depth of the basin and of the necessity for keeping the long side clear for unloading the building, material had to be handled two or three times. The total working time for the truck crane was 142 hr.—from 9 to 19 hours per day—and 3,190 cu.yd. of wet clay was handled, an average of 22 cu.yd. per hour. This record is exceptional especially because of the nature of the ground (made from Delaware River dredging); of incessant rains before and during the excavating; of night work for one-third of the job; and of the digging of one-fourth of the yardage in the wet. The basin was ready to receive the barges 8 days after digging began.

In the meantime, the building was moved to the river on schedule, and at low tide it was pulled on to the barges. On the following high tide the barges floated off and the building began its 4½-mi. water journey. The next morning it was pulled off the barges and transferred to its new foundation.

The success of the initial operation has made certain the moving of about seven more buildings during 1932. The significant features of the jobs are that, except for barges and towing tug, only military equipment was used. The work was done entirely with personnel of the 1st U. S. Engineers, Lieut.-Col. Lewis H. Watkins, commanding. Field operations were in charge of Capt. R. D. Ingalls and Lieut. J. G. Christiansen.

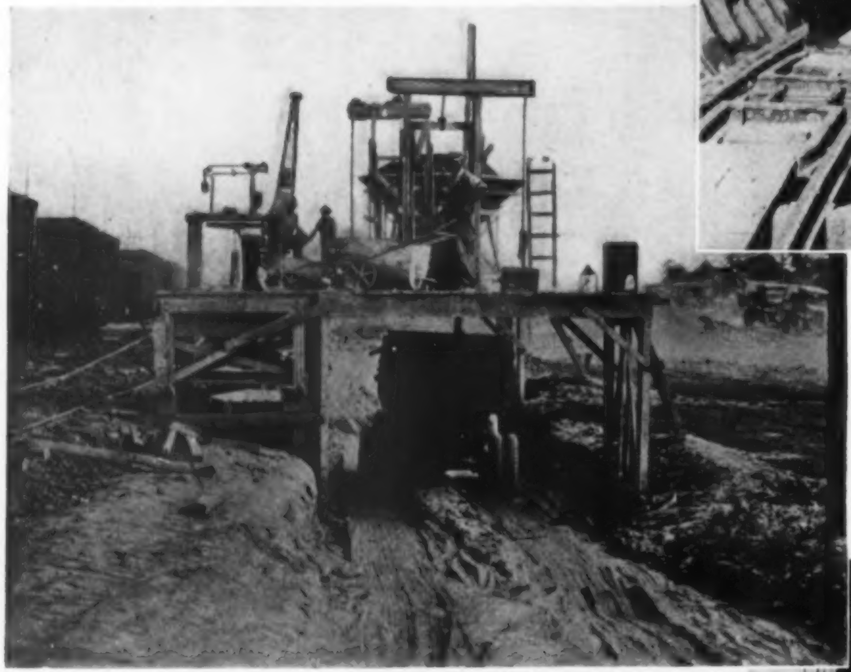


REGIMENTAL EQUIPMENT, including truck crane, was used exclusively in excavating barge basin, jacking building and moving it to new location.

Getting Down to DETAILS

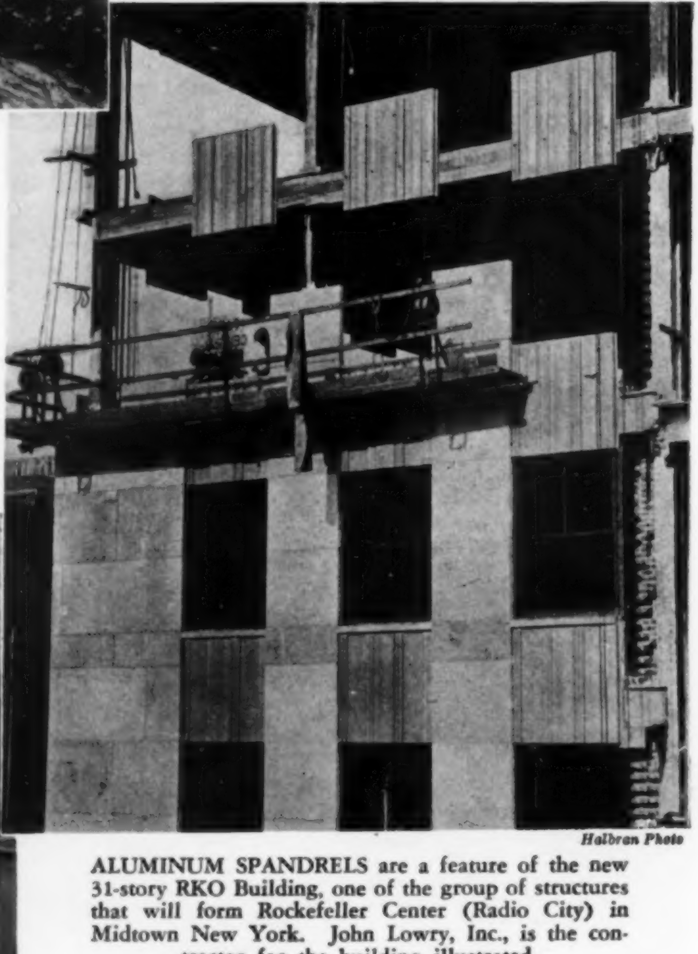
Close-up Shots of Job Methods and Equipment

CAR SWITCHER, operated by compressed air, is used by S. S. Magoffin Co., in tunnel at Owyhee dam, Oregon. Wheeled carriage on transverse tracks runs under car train, picks up empty with jacks and removes it to side. Train proceeds to heading and front car is loaded. Train then runs back past switcher which feeds new empty on front end of train for next loading. Designer of switcher, FRANK PURVIS, superintendent, at left; H. J. SCHAAB, at right.



FOR HANDLING BULK CEMENT on construction of 8-mi. concrete road in Delaware County, Ohio, W. L. Johnson Construction Co., of Hicksville, used specially built two-wheeled carts to transfer cement from railway cars to chute in platform over motor-truck driveway. Features of carts are "coal-scuttle" nose, accurate balance and low mounting on 18-in. wheels for easy loading and discharge. Dumping chute is raised and lowered by counterweights. Elevated platform is built in sections for dismantling and reassembling.

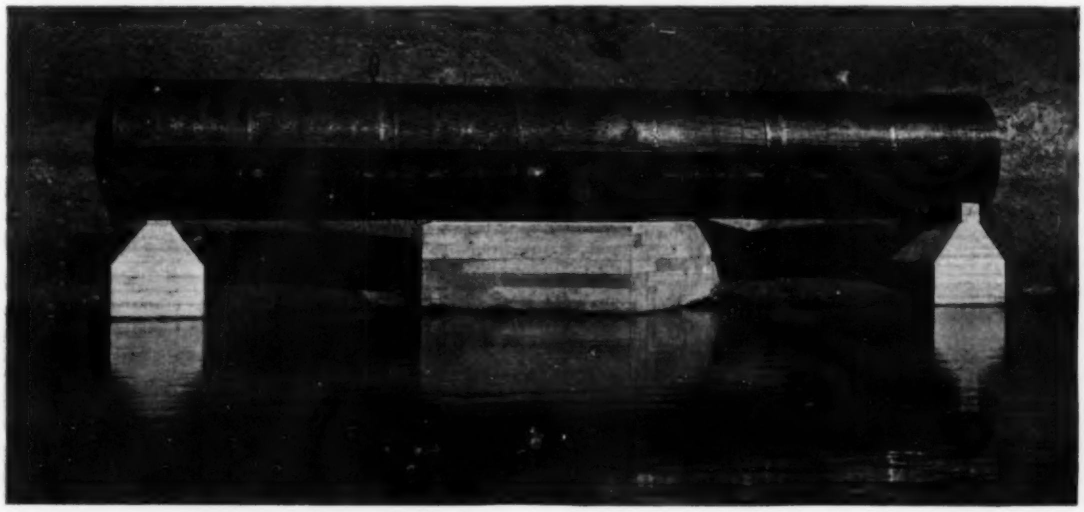
SPLIT FLOAT *(below)* assures level pavement across expansion joint. Notch in float fits over 1¼-in. bulkhead, permitting workmen of Roberts Construction Co., Lincoln, Neb., contractor on 11½-mi. job for Kansas highway department, to finish both sides of joint simultaneously.



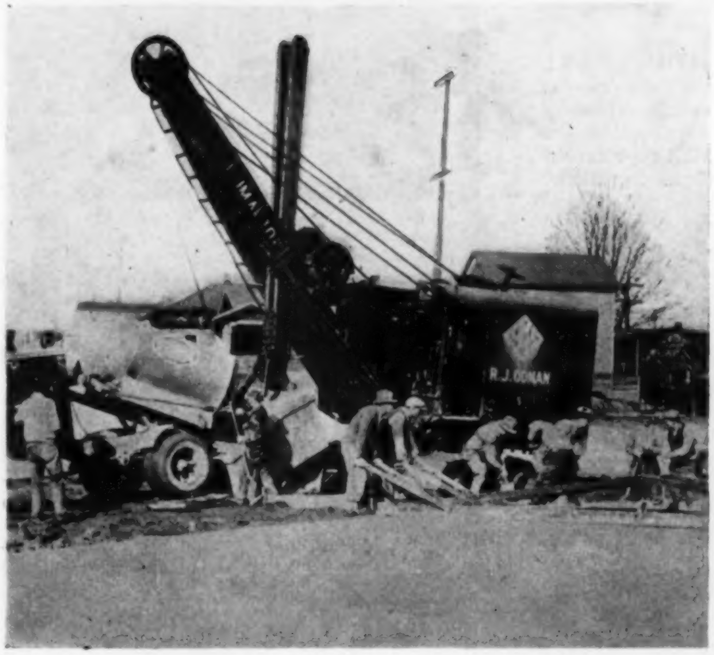
Halbran Photo

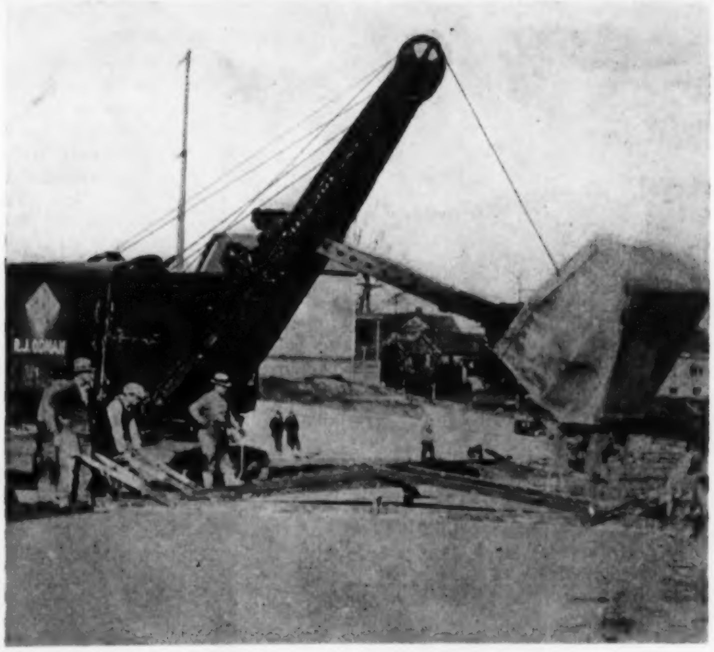
ALUMINUM SPANDRELS are a feature of the new 31-story RKO Building, one of the group of structures that will form Rockefeller Center (Radio City) in Midtown New York. John Lowry, Inc., is the contractor for the building illustrated.

HANGERS USED AS POSTS in erecting 547-ft. steel arch for Tyngsborough bridge over Merrimac River at Lowell, Mass. Reversing usual procedure, Boston Bridge Works first built bridge floor on timber falsework and then built up arch trusses from each end by employing the steel I-section hangers as temporary columns until closure was made at center. Erection was done with rail-mounted 15-ton traveler having 90-ft. boom. Bridge built for Massachusetts Department of Public Works, Arthur W. Dean, chief engineer, and G. E. Harkness, bridge engineer. General contractor, Simpson Bros. Corp., Boston.



INTAKE SWIRLS ELIMINATED *(left)* by new design of horizontal, instead of vertical, screened cylinder at Crystal Springs reservoir, San Francisco. Cylinder, 6½ ft. in diameter and 44 ft. long, has area of screened openings five times that of inlet mouth. T-connection projects 2 ft. into circular mouth of inlet. Provision is made for placing a system of guide vanes over the top of the screens as further insurance against vortex action of water.





POWER SHOVEL PLACES CONCRETE for paving approach to bridge at Seattle, Wash. West Construction Co. equips dipper-stick of Lima shovel with specially designed 2.1-yd. bucket having bottom in which trap-door is tripped by shovel operator. Trucks dump into bucket 2-yd. batches of mixed concrete from plant of Pioneer Sand & Gravel Co. Paving done in half-widths, varying from 20 to 24 ft. each. Total concrete yardage 17,544. Scheme proved useful in keeping trucks off subgrade especially where reinforcement was used or where earth was soft after rains.

Step-by-Step
Erecting Flat Steel Panel Forms

RATHER than spend \$5,000 for lumber which would be too cut up by the end of the job to have any salvage value, the F. N. Lewis Co., Inc., of New York City, contractor on a sewage treatment plant at Little Falls, N. J., invested in 3,000 sq.ft. of flat steel panel forms and adapted them successfully to the construction of the circular battered walls of two 100-ft.-diameter filter tanks. Only standard rectangular Metaforms of the Metal Forms Corp. were needed on the vertical exterior face of each of the two walls, which averaged 6.75 ft. in height; but adjustable units had to be employed, in addition, on the inside face to take care of the batter and fractional units to keep the spreader holes in alignment.

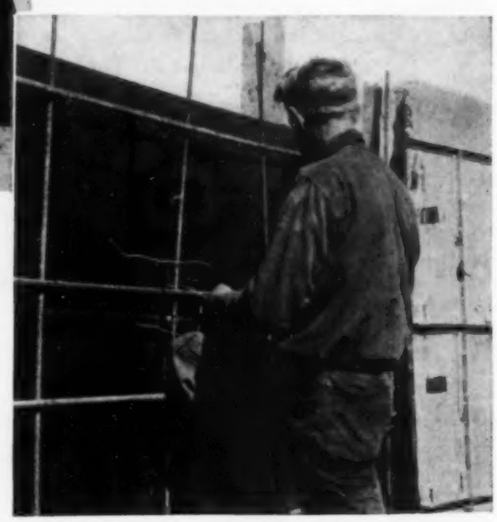
Each filter wall was poured in four sections. The area of the steel forms was sufficient for two sections, allowing the contractor to keep form erection one step in advance of stripping and cleaning. Floors of the filters

1 TO PROVIDE LEVEL BASE for erection of rectangular steel panel forms, carpenters place tapered wood bottom strip to take care of 6-in. slope in concrete floor. Height of strip diminishes from 6 in. at diametrical gutter to zero as it approaches point on circumference farthest from gutter.

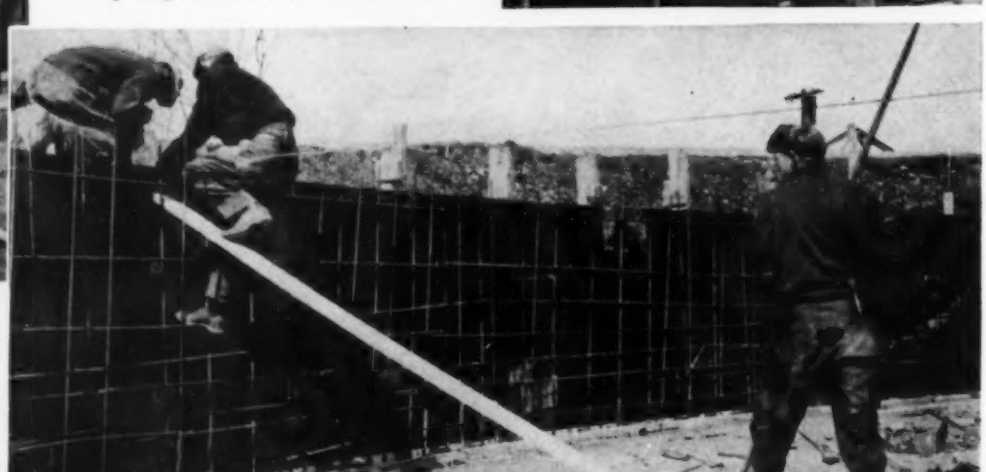
2 THREE FORM PANELS *(below)* are left in place on completed wall to guide erection of forms for next section.

3 AFTER VERTICAL OUTSIDE FORMS HAVE BEEN PLACED, reinforcing steel is erected with Bates wire ties twisted by special hand tool. Steel dowels in concrete floor are used to block wood base strips of inside and outside forms on true circles. Wood strips are wired to each other at correct spacing of 12 in. for base thickness of wall.

4 REINFORCING STEEL *(right)* is tied to outside forms to hold it at proper distance from battered inside face of wall.



5 MEASURING WITH STEEL TAPE *(below)* from fixed point at center of tank, workmen adjust top of outside forms to true radius and anchor it in correct position by spiking outside shores to stakes.

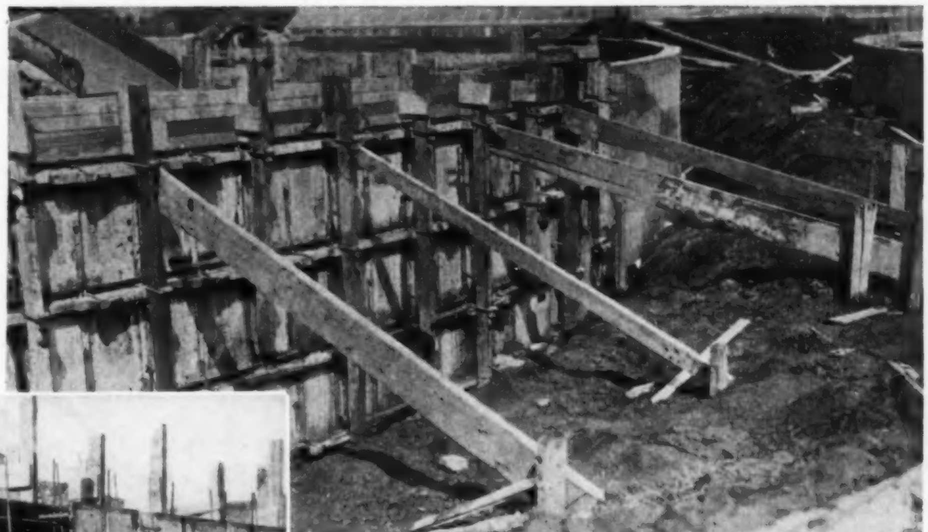


Field Methods
for Circular Battered Walls

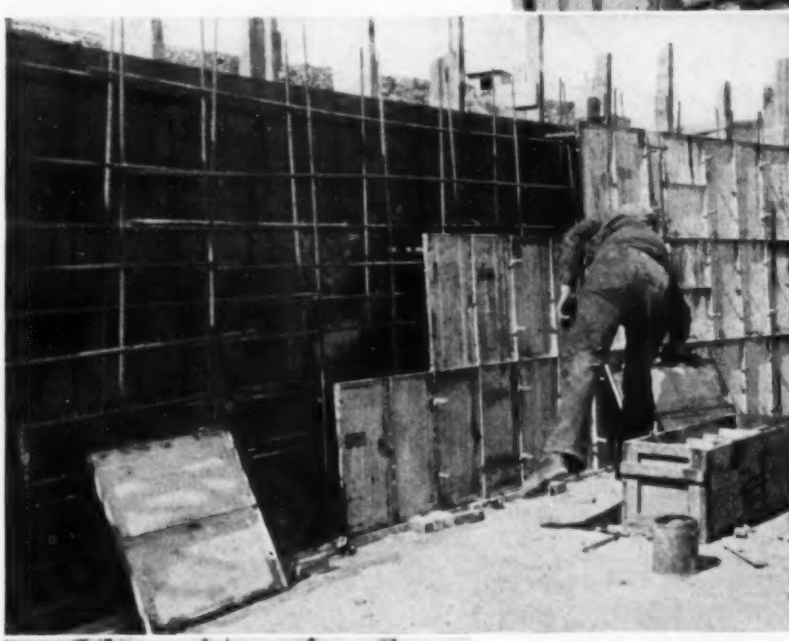
sloped 6 in. to a diametrical gutter. To provide a level base for the rectangular forms, a tapered wood strip was laid on the sloping floor.

Standard form units were 24x24 in. in size. Fractional units were ordered, all 24 in. high, in widths of 2, 3, 4, 5, 8, 12, 16, 18 and 20 in. The form equipment also included inside and outside corner pieces and hinged corners.

Under the direction of Woodruff Smith, secretary, the F. N. Lewis Co., Inc., built the complete treatment plant.



6 WITH BRACES SPIKED TO ANCHOR STAKES, outside forms are held in true position to guide erection of inside forms. Wales and studs of inside forms, erection of which will be shown, are similar to those of outside forms. Wall forms are braced on outside only.



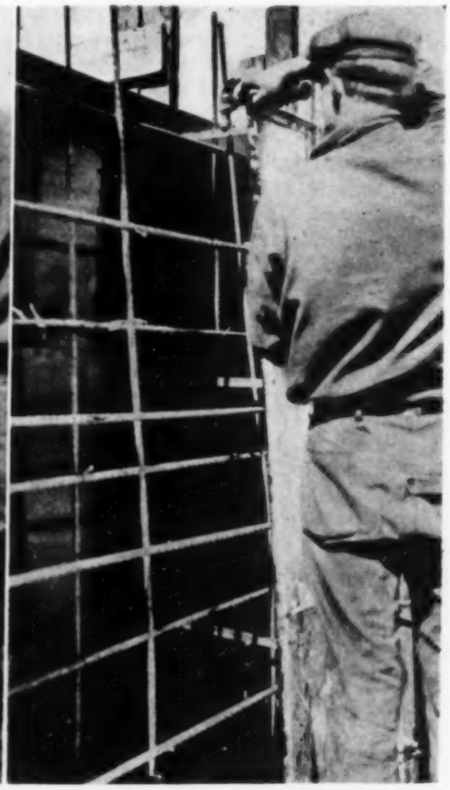
7 STEEL PANEL FORMS are quickly erected. One man sets up as much as 120 sq.ft. an hour of inside forms, with another man on outside to twist ends of spreaders.

8 LIGHT IN WEIGHT, steel panels are easily handled by one man. Standard unit is smooth 14-gage sheet metal 24x24 in. in size reinforced by 1-in. angle-iron frame and vertical brace through center. On other units, braces are horizontal.

9 FIRST CLAMPING OPERATION consists in raising two clamps attached to flange and tapping them with hammer to lock adjoining flanges together. To right of clamps are (1) special short unit and (2) adjustable unit, attached to standard unit by long bolts.

10 FACE OF PANEL (*left*) with adjustable unit attached. Adjustability of bolted unit makes it possible to use standard rectangular panels on battered circular wall.

Step-by-Step
Erecting Flat Steel Panel Forms



11 AFTER CLAMPS ON VERTICAL FLANGE HAVE BEEN LOCKED IN POSITION, tapered keys are driven through holes in horizontal flange to connect form panel to unit below. Clamps and keys hold unit securely and leave both hands of workman free to insert spreader ties and erect next panel.

12 EACH STANDARD FORM UNIT has slotted holes for five spreader ties, one at each corner and one at center. Spreader tie is notched length of strip steel with notches spaced proper distance apart for thickness of wall. Where necessary, cups can be used on spreader ties to break ties off back in concrete. Cups are not required on this job.

13 AFTER INSERTING SPREADER TIE THROUGH HOLES OF FORM UNITS, workman taps tie until notches slip down over light-gage steel forms, thus locking opposite forms at correct distance apart.

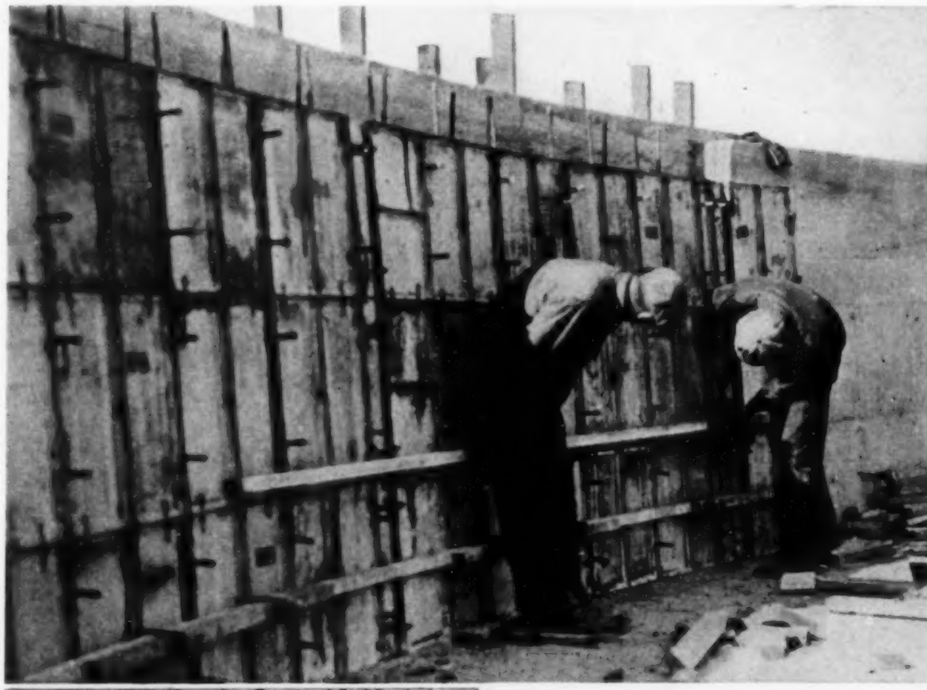
15 OUTSIDE ENDS OF SPREADER TIES are twisted by workman with wrench as fast as ties are inserted. Ends must be twisted to keep ties from jumping out of slots when puddlers work concrete.

14 SPREADER-TIE BOX has compartments for seven lengths of ties to provide for changing wall thickness from 12 in. at bottom to 8 in. at top. Metal Forms Corp. supplies lengths of 8, 10, 11 and 12 in.; intermediate sizes of 8½, 9½, and 11½ in. are made on job.

16 SPECIAL WRENCH supplied by form manufacturer can be used to advantage for twisting inside ends of spreader ties, where no wales or studs interfere with long-handled tool.

Field Methods (*Continued*)

for Circular Battered Walls



17 HORIZONTAL WALES are 2x2-in. timbers. On straight walls, 2x4-in. timbers would be used; but lighter sticks are employed for curved wall because they can be bent to shape of form.

18 CLAMP for locking wale to form has two legs which hook in holes of panel flange. Made for 2x4-in. wale, clamp is used with 2x2-in. timber by filling in with short 2x2-in. piece.

19 BY FILLING IN WITH 2x2-IN. PIECE, clamp designed for 2x4-in. timber holds 2x2-in. wale. Head of clamp locks wale to form when handle is pressed down.

20 STUDS *(right)* are 2x4-in. timbers hooked to wales with clamps similar to those used on wales. Timber framework consists of four horizontal wales and of studs spaced 4 ft. apart. Wood strip about 10 in. high on top of steel forms raises formwork to full height of wall.

21 STURDY STEEL FORMS *(left)* permit rapid placing of concrete and yield practically 100 per cent salvage at end of job. Truck-mixed concrete is placed by conveyor.

County Builds Concrete Roads in SINGLE-TRACK WIDTH

By E. M. FLEMING
Manager, Highways and Municipal Bureau, Portland Cement Association

IN 1914, Iroquois County, Illinois, began the improvement of local roads by constructing 6.7 mi. of single-track concrete road. Since that time this type has been used on local routes until now there are more than 145 mi. in the county. Thirty-five miles more are scheduled for construction at an early date.

These roads have been built on the center-line of the roadway for a width of 10 ft. with 10-ft. earth shoulders on each side, to give a roadway width of 30 ft. On the more lightly traveled roads these shoulders have become sodded at the edge of the pavement so that no difficulties are experienced in driving on or off the slab. Even where the shoulders are not sodded the earth becomes tightly compacted along the pavement edge and although reduced speeds are necessary in passing from the slab to the shoulder in wet weather, there are no accidents or extreme inconvenience.

The construction of single-track concrete roads offers several advantages to the contractor. Forms may be set and fine grading finished for a considerable distance ahead of the mixer. The two wide shoulders supply sufficient room for the mixer and for hauling material to the mixer so the subgrade need only be prepared once for paving. Turntables can be eliminated by the simple means of routing incoming trucks on one side of the roadway and returning trucks on the other side.

The finishing operation is simplified by the fact that the width of surface between the forms is only 10 ft. As a result very little working and surface manipulation is required. Usually one trip over and back with the longitudinal float removes all excess laitance and water and produces a surface well within the requirements for smoothness, which permits ⅛-in. variation on a 10-ft. straightedge. As a matter of precaution, the longitudinal float is followed by a long-handled float and the pavement is then straightedged. It has been found advantageous to use a hand canvas belt as a final finishing operation rather than to use the belt on the finishing machine.

The economies that accrue to the contractor on this type of work are best illustrated by bid prices. The last project let to contract in the county averaged $10,381.25 per mile for the 10-ft. slab and edge bars. Each year's construction has averaged almost 10 mi., with the exception of the war years. The 1931 program was 17.4 mi.

FORMS AND EDGE BARS are set 1,200 to 1,800 ft. ahead of concreting, since shoulders are used by mixer and for hauling.

LONGITUDINAL FLOAT, in trip across and back, removes excess water and laitance and trues up surface.

LONG - HANDLED FLOAT, and straightedge *(below)* follow longitudinal float.

FINAL FINISH is obtained by hand belting to meet smoothness requirements of not more than ⅛ in. variation in 10-ft. length

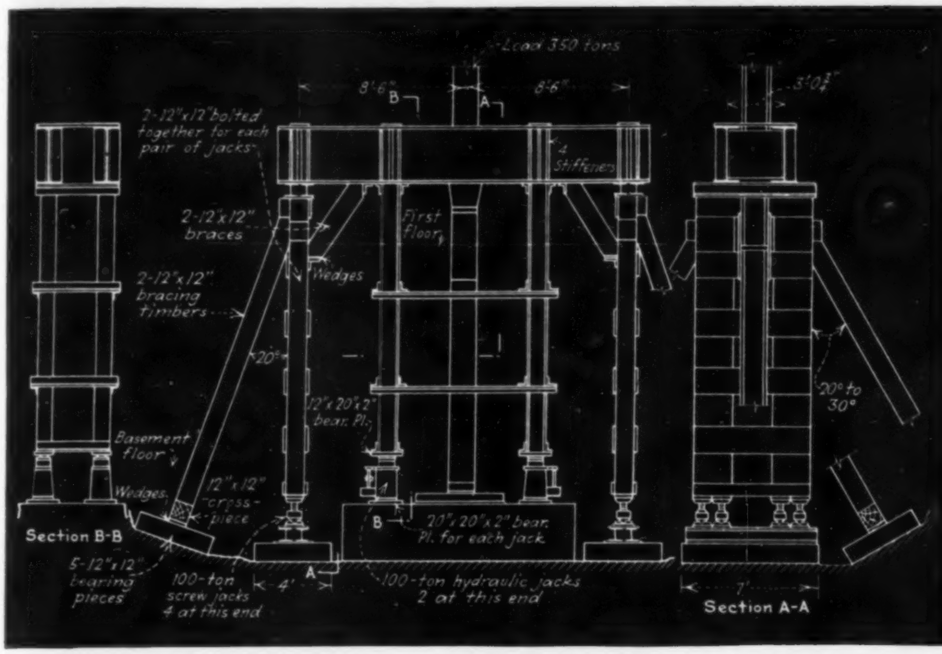


Fig. 1. **COLUMN SHORING and pretesting details of new footings for Onondaga County Savings Bank Building.**

PRE-STRESSED FOOTINGS

Prevent Settlement During Alterations to 7-Story Bank Building

By W. T. McINTOSH

Engineer, Spencer, White & Prentis, Inc., New York

EXTENSIVE alterations and improvements have recently been made in the Onondaga County Savings Bank Building at Syracuse, N. Y. This is a bank and office building, of steel frame construction, seven stories in height. A large part of the first two floors is occupied by the main banking room which is a large, handsome room two stories high.

In order to increase the size of the main banking room and the safe deposit department in the basement below, several of the main columns of the building were to be removed from the basement and from the first and second floors. Girders were installed at the third floor level to carry the upper five floors of the columns whose lower parts were removed, and new columns on new footings were installed under the ends of these girders to support them.

This work was all done without disturbing tenants above the second floor. Both the work and, what is equally, if not more, important, its effect, were confined to the lower floors.

In making the alterations it was of the utmost importance to prevent settlement of the parts of the structure to be supported by the new columns and girders, and to prevent the cracks and other damage which would naturally accompany such settlement. This was accomplished by pre-stressing the new members. Two distinctly different operations were performed: first, the compressing of the soil beneath new

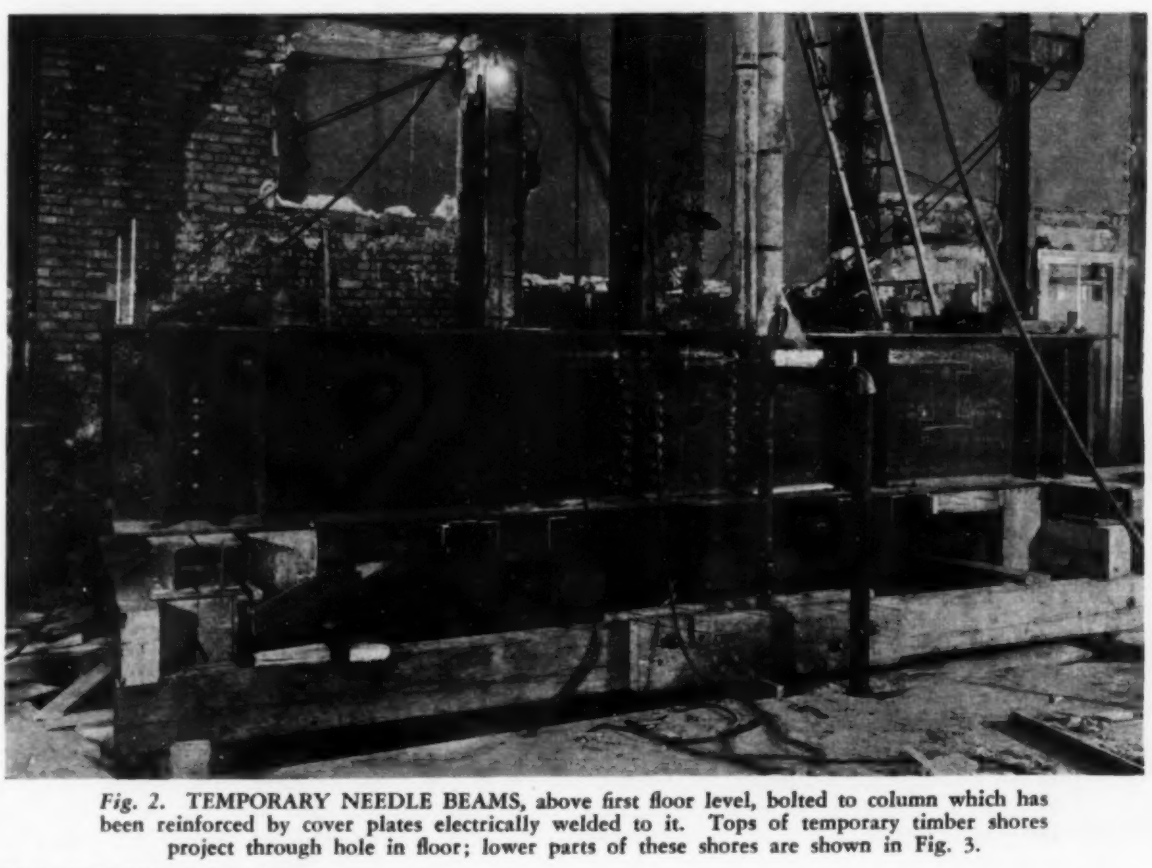


Fig. 2. **TEMPORARY NEEDLE BEAMS, above first floor level, bolted to column which has been reinforced by cover plates electrically welded to it. Tops of temporary timber shores project through hole in floor; lower parts of these shores are shown in Fig. 3.**

column footings, and, second, the deflecting of the new girders.

Pretesting New Footings—The method of pre-stressing the new column footings, commonly called "pretesting," is illustrated in Figs. 1, 2 and 3. In the particular case illustrated, instead of installing a new column to carry the new girder at the third floor level, an old column was reinforced by the addition of cover plates above the first floor level and a new section of column was installed to replace the old pier below the floor level. This necessitated needling and shoring of the column while a new and larger footing was installed. Two 36-in. girder-beams were bolted to the column, through suitable connections, to act as needles. Under the ends of these needles were installed towers of 12x12-in. timbers on screw-jacks supported by temporary concrete footings and grillages.

The load of the column, about 350 tons, was transferred to the needles by means of screw-jacks, and the old column base, the masonry pier below first floor and the old footing were then removed. A new and larger footing was installed, and the new section of column and billet were set in place. Two steel towers were then installed under the needle-beams, each tower consisting of two 10-in. H-beams, the four beams being tied together horizontally by angles for stiffening. Under each of the small billets attached to the H-beams constituting the towers were placed two 50-ton hydraulic jacks, providing a total jacking capacity of 400 tons.

When all was ready the hydraulic jacks were put in operation, thus transferring the load of the column from the timber towers and temporary footings to the jacks on the new permanent footing. The result was to depress the new footing, compressing it and the material beneath it, under a load of 400 tons, that test load being in excess of the load ultimately to be carried. Then, while the full test load of 400 tons was maintained on the jacks, long steel wedges were driven between the column shoe and the billet on the concrete footing. The wedges were driven up until the pressure gages on the jacks indicated, by a dropping of the pressure at each hammer blow, that the load had been transferred from the jacks to the billet. The wedges were then carefully grouted in to prevent their movement, and the needles and other temporary works were removed.

This method of jacking down a footing and transferring the load by wedging while the pressure is maintained on the jacks, known as the Pretest method, is patented. Its purpose is to compress the footing and to compact the material beneath it and then, equally important, to maintain the compression so that rebound cannot take place. If the pressure were released, rebound would occur and subsequent loading would cause settlement as the ground was recompressed, with consequent damage to the structure.

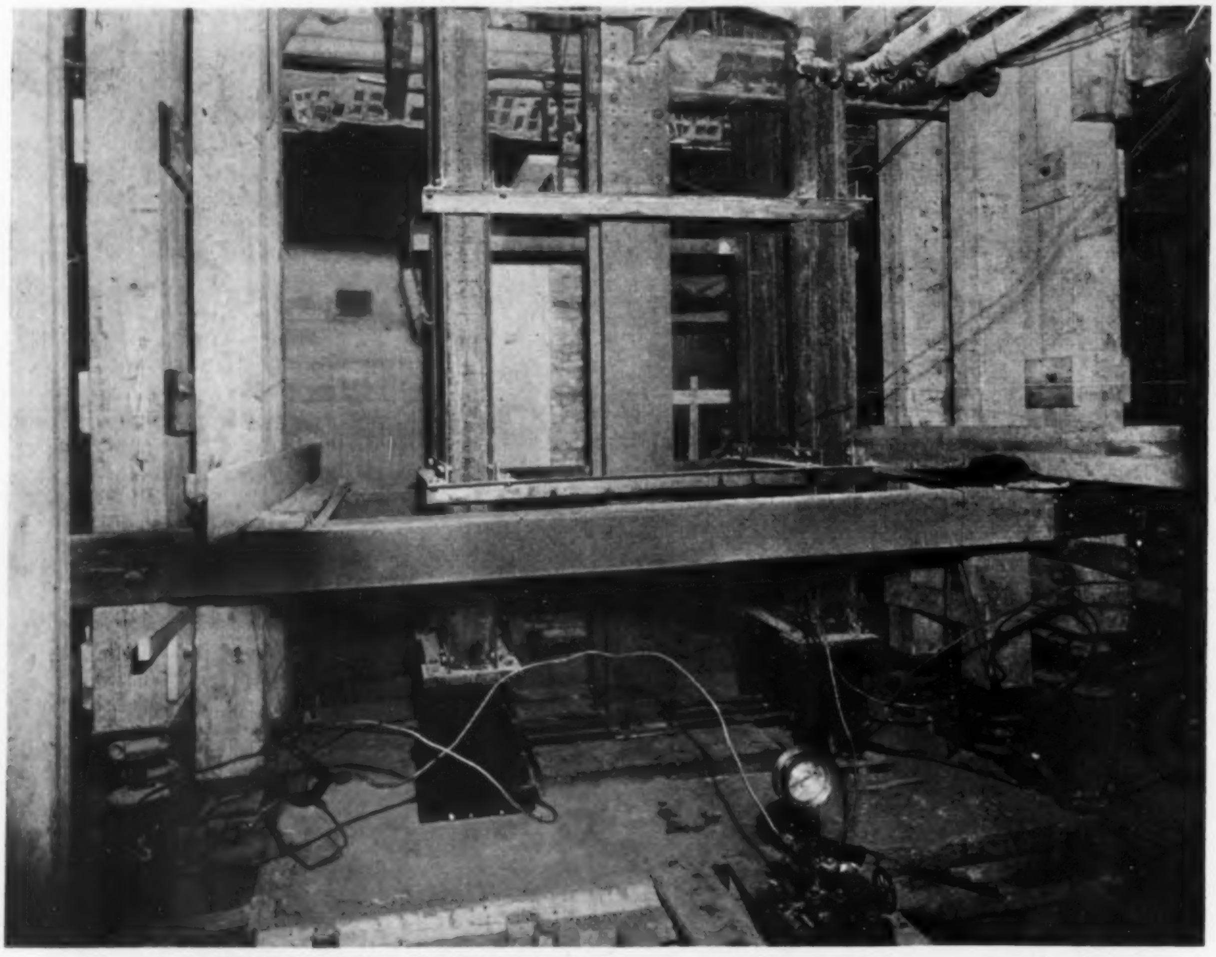


***Fig. 3.* PRETESTING NEW FOOTING for column temporarily supported on screw-jack shores through needle-beams shown in Fig. 2. Hydraulic jacks are in place under temporary steel tower, eight 50 ton jacks being used in place of four 100-ton jacks shown in Fig. 1. Steel wedges for permanently transferring load are in place between column shoe and billet, ready for driving.**

Pre-Stressing the Girders—The stressing of the girders is shown in Figures 4 and 5. In the case illustrated, which is typical, the new girder consisted of two parallel 66-in. plate girders, one each side of the column to be carried. This double girder was installed immediately below third floor level so that the column could be attached to it at that level and removed below it. Hanger-plates were attached to the girders by suitable connections

Fig. 5. PRE-STRESSING *(above)* one of the girders. Hydraulic jacks are in place between temporary needle-beams and temporary beams below them, which are suspended from girder. After stressing girder and riveting column to it, the column is cut off just below the girder.

on each side of the column. To the lower ends of these hanger-plates were fastened two short 36-in. I-beams with stiffeners and small billets. Above these beams, two needle-beams, each consisting of a 36-in. girder-beam with stiffeners and billets, were bolted to the column through channel connections. Four 100-ton hydraulic jacks were placed between the billets of the needle-beams and those of the beams fastened to the hangers from the new permanent girders.

When all preparatory work had been completed the hydraulic jacks were operated, transferring the load of the column, about 400 tons, from its old footing to the new double girder through the temporary beams and hanger-plates. The result was to deflect the new girder as it would have deflected ultimately if the column had simply been riveted to it and then cut off below. In the latter case, however, the deflection would have caused settlement of the column and other parts of the structure carried by it, with cracking and other damage. This was avoided by the pre-stressing of the girder.

While the deflection of the new girder was held by the hydraulic jacks, permanent connection brackets on the column were drilled to match holes in the girders and riveted, thus permanently transferring the column load to the new girder, and the jacks were slacked off. This is a variation of the Pretest method of transferring a load under which the transfer of load is made while the full pressure is held on the jacks so that no rebound can take place. Rebound, or release of the deflection in the girder would, of course, be followed by a second deflection when the load of the column came on it and would result in damage.

After completion of the transfer of load by wedging, the jacks, temporary needles and beams, and hanger-plates were removed. The column was then cut off below the new double girder and was removed.

The architects for the alterations to the building were Halsey, McCormack & Helmar, Inc., New York. The structural work, including the pre-stressing of the footings and girders, was designed by Lange & Noska, consulting engineers, New York. J. D. Taylor Construction Corp., Syracuse, was the general contractor. Spencer, White & Prentis, Inc., New York, were subcontractors for the foundations and for the pre-stressing described.

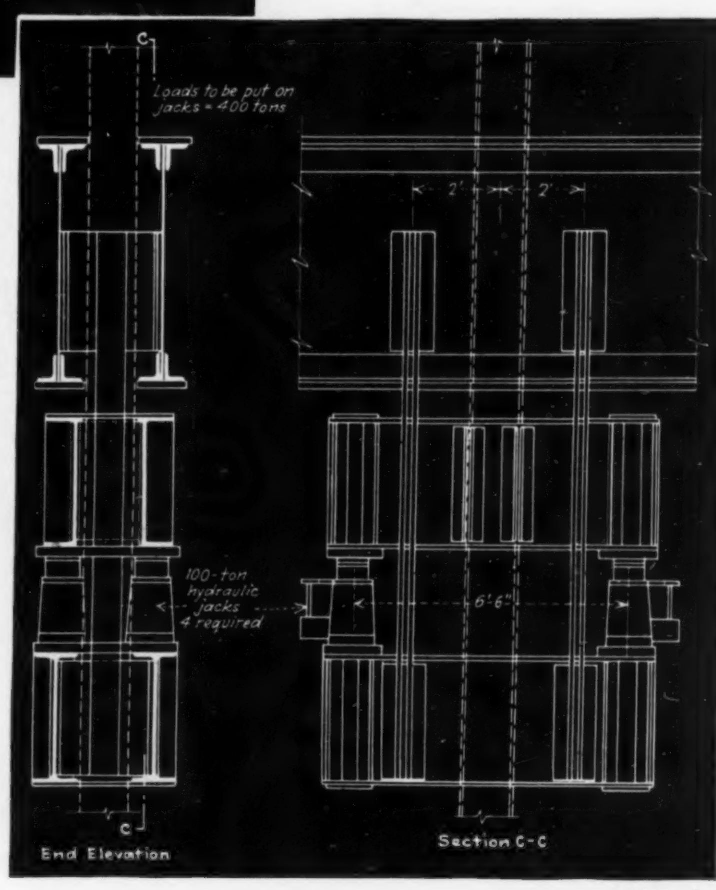
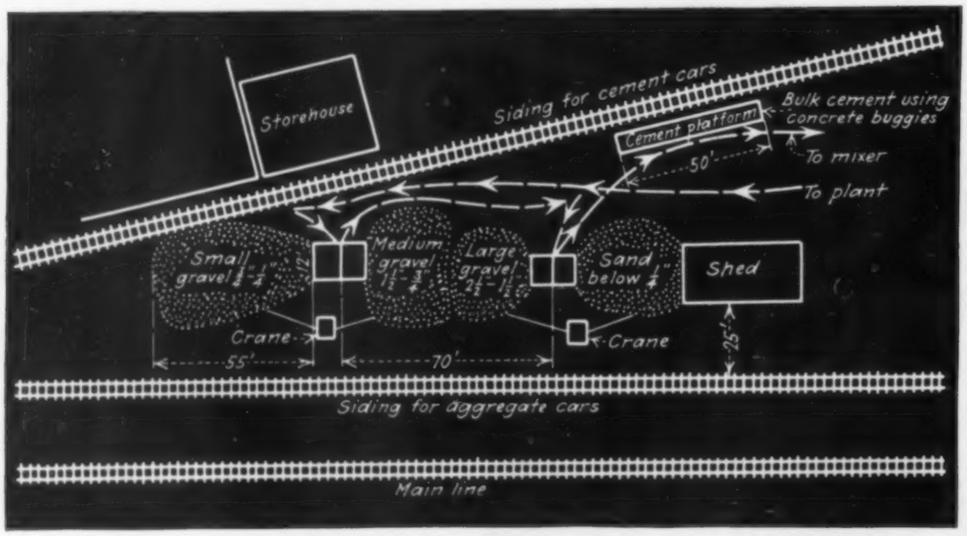


Fig. 4. METHOD *(right)* of putting deflection into new girders.

YARD LAYOUTS—*Good and Bad*

Report by T. C. Thee, Assistant Highway Engineer, U. S. Bureau of Public Roads, Indicates Possibility of Savings by Efficient Arrangement of Plant

Fig. 1. **CROWDED CONDITION of this set-up for handling three sizes of coarse aggregate caused trucks to lose 2 min. per load. An extra crane also was required.**



AS PART of a field study of various factors affecting rates of production of concrete paving, the Division of Management of the U. S. Bureau of Public Roads investigated the general subject of the layout of contractors' material yards on two representative Wisconsin projects, with particular reference to the influence of yard layout on construction progress. A report of the results of the investigation, by T. C. Thee, assistant highway engineer, is the source of the following notes:

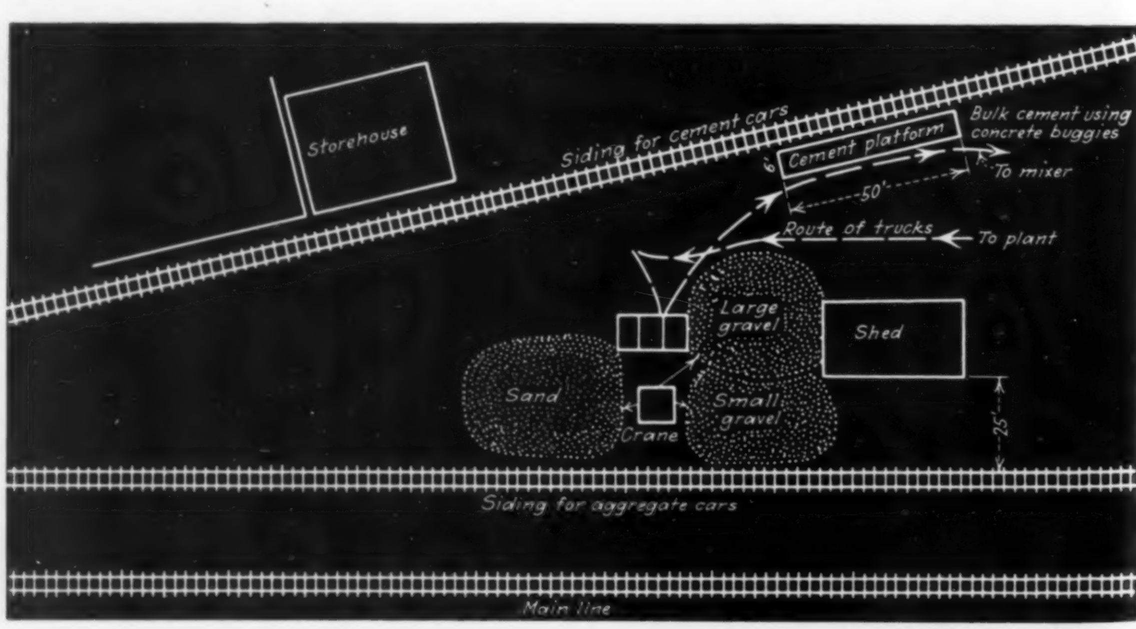
The two contracts studied were 20-ft. wide concrete roads, 9-6½-9 in. thick, 9.88 and 11.27 mi. long, respectively. Coarse aggregates in three sizes, in addition to the sand, were proportioned by weight. Bulk cement was used.

Fig. 1, showing the plant layout for using three sizes of coarse aggregate on the first contract, illustrates a very crowded condition. Trucks lost on an average of 2 min. per load more than was necessary for a typical set-up, requiring one and sometimes two trucks more than would have been used normally. An extra crane was also required. The materials were delivered by rail.

Fig. 2 is the same plant site as in Fig. 1, but with equipment and stockpiles planned for handling two sizes of coarse aggregate. In so far as the cost of handling the aggregates and batching is concerned, this set-up would not result in any more cost for handling the two sizes than if only one size of coarse aggregate were used.

Fig. 3 is the plant layout for the second project, showing the number of turns and maneuvers that the trucks had to make in order to obtain a load. Fig. 4 shows the same set-up with a recommended change that could be used on similar jobs. Turning time for the trucks would then be eliminated. If only two sizes of coarse aggregate had been specified, a 3-compartment bin could have been used which would have required but one stop for the trucks. This would have been a most economical set-up and would still have utilized the advantage of multiple-sized aggregates. Material was delivered by truck from a local pit and only one crane was necessary to supply the mixer demand for aggregates. This crane supplied material for the mixer when a 33-cu.ft. batch and a 50-sec. mixing time were used. An average of fifty-five 33-cu.ft. batches an hour were taken care of by the crane. This means that the crane

Fig. 2. **REARRANGEMENT of layout in Fig. 1 with equipment and stock piles planned for handling two sizes of coarse aggregate.**



handled an average of 238,931 lb. of sand and gravel, or about 80 cu.yd. of material, per hour.

Fig. 5 shows a set-up handled by one crane and utilizing straight-line loading. Bulk cement was placed in the batch between the stone and sand, eliminating the time usually required for covering the cement. This method proved very satisfactory. Some engineers, however, prefer to have the order of loading changed to second-size aggregate, sand, cement and then coarse aggregate.

Incidentally, this contractor was using sack cement but obtained permission to try bulk cement, which resulted in a saving of 11 cents on each barrel of cement. The cement retained in the empty sacks had averaged about 0.4 lb. per sack.

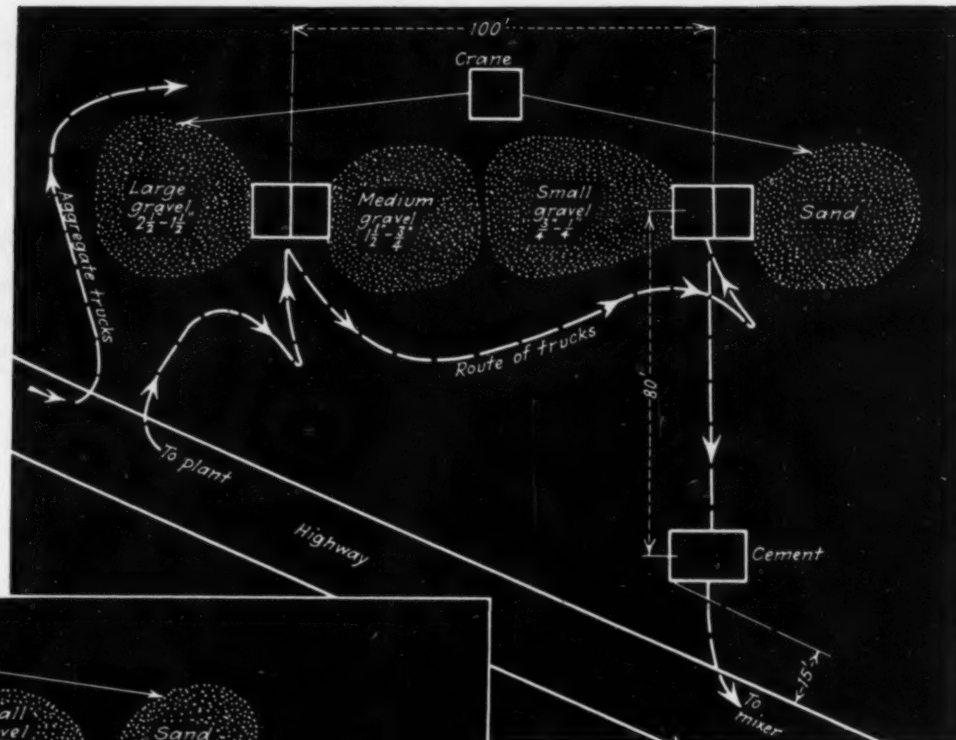


Fig. 3. **TIME-WASTING SET-UP *(above)*. Sketch indicates number of turns and backing maneuvers that trucks had to make in order to obtain a load. Three sizes of coarse aggregate.**

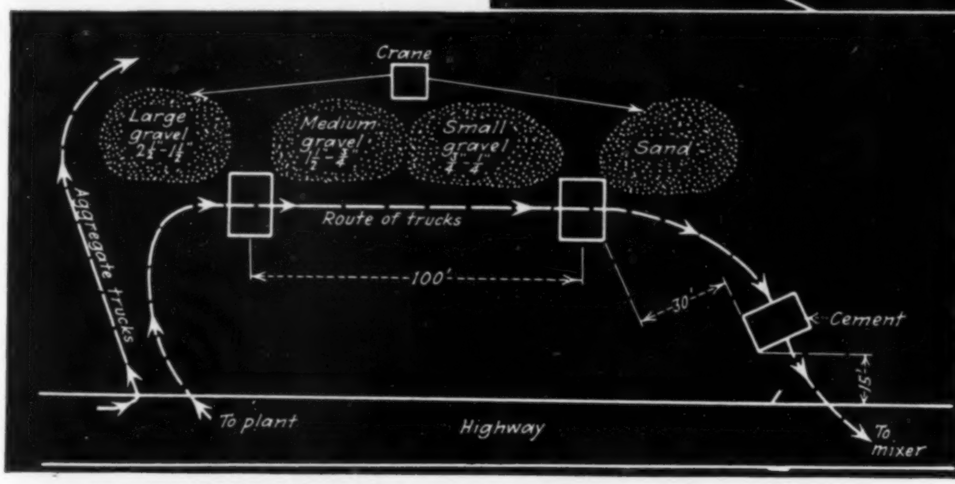


Fig. 4. **IMPROVEMENT on set-up of Fig. 3. Rearrangement eliminates turning time for trucks. Three sizes of coarse aggregate.**

Up to the present time the most popular way of handling bulk cement at the batcher plant, and the way used in this case, is by 2-wheeled concrete buggies. Two cars of cement are unloaded at the same time. A wooden platform is constructed to the same elevation as the box-car floor with a length sufficient to reach the doors of both cars. Usually two men in each car load the buggies, two men wheel the buggies to a platform scale and two men weigh and finally dump the cement into the trucks.

Both jobs employed a straight-line loading of the trucks for the bulk cement, which reduced the amount of turning and backing required in taking on a load. Delaying a 3-batch truck 1 min. represents a loss of about 5 cents. This item may seem small but it accumulates rapidly into a large sum. Delaying the mixer 1 min. often represents the loss of about $1. On a paving job where operations should synchronize and coordinate, minutes lost are dollars wasted. An efficient batching plant eliminates delay.

Hasn't YOUR work developed examples of good—or bad—yard layouts? The Editor will welcome blueprints or sketches from you.

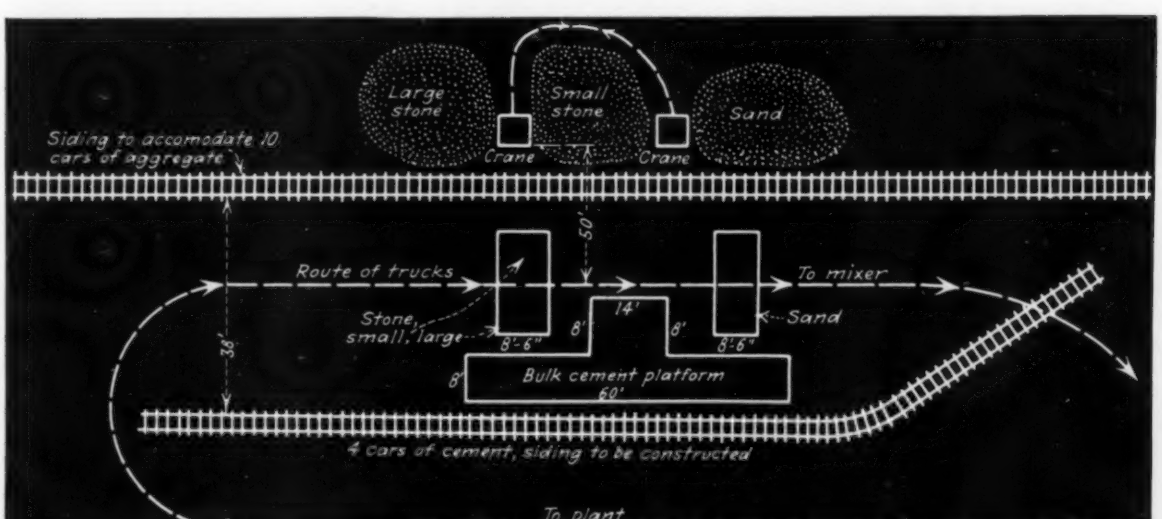
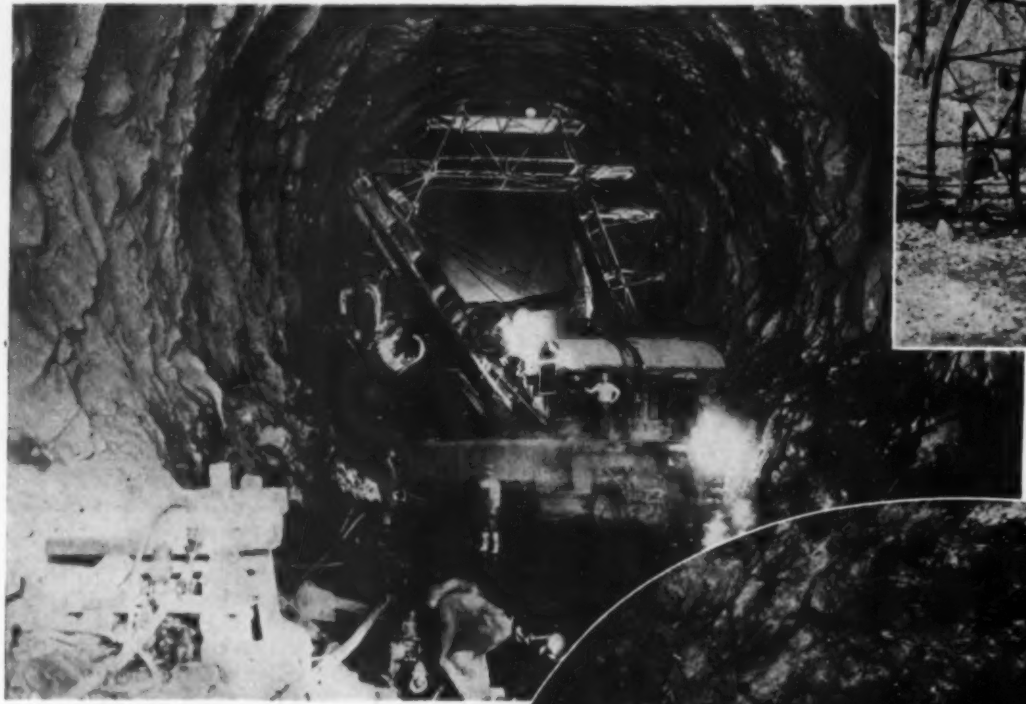


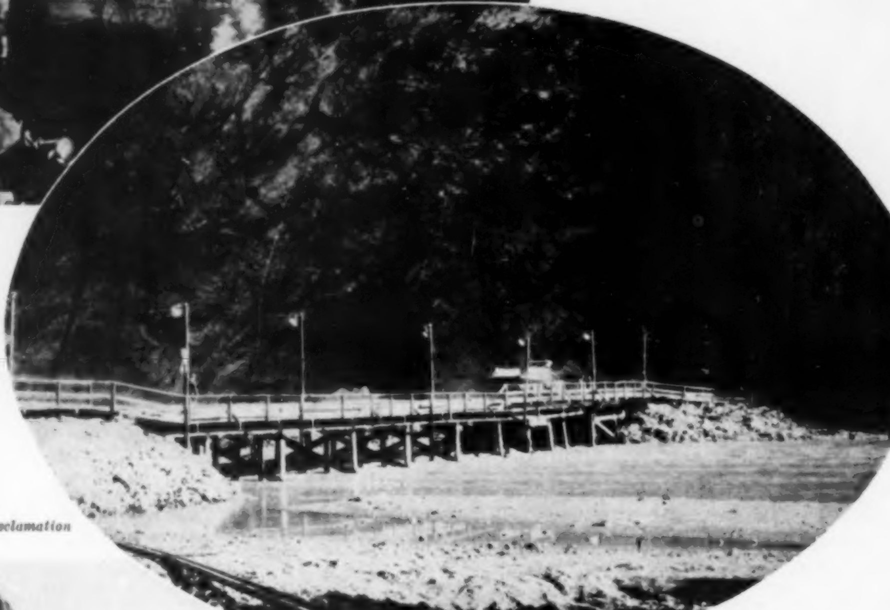
Fig. 5. **STRAIGHT-LINE LOADING adapted to bulk cement. Trucks loaded mechanically or with concrete buggies. Sand used for cement coverage.**

Construction Progress at HOOVER DAM

STEEL - FRAME TEMPLET erected to facilitate trimming and measuring of 56-ft.-diameter rock sections of diversion tunnels.



INVERT SECTIONS of diversion tunnels are being excavated in rock. Power shovel loads spoil into motor trucks for removal to dumps. In background is steel-frame measuring and trimming templet equipped with working platforms at four levels. Templet is mounted on wheels which ride on rails along tunnel floor.



TIMBER BRIDGE *(above)* built by Six Companies, Inc., across Colorado River above Hoover damsite gives access to inlet portals of diversion tunnels.

Photos, U. S. Bureau of Reclamation

FOR BATCHING AND MIXING CONCRETE *(left)* the contractor has installed a low-level plant near river level equipped with four 4-cu.yd. mixers, with provision for two more. Production capacity is 280 cu.yd. of concrete per hour. Five sizes of aggregate are handled by automatic weighing and recording devices. Total concrete required for project is 4,500,000 cu.yd. Later, mixing plant will be shifted to higher level on side of canyon.

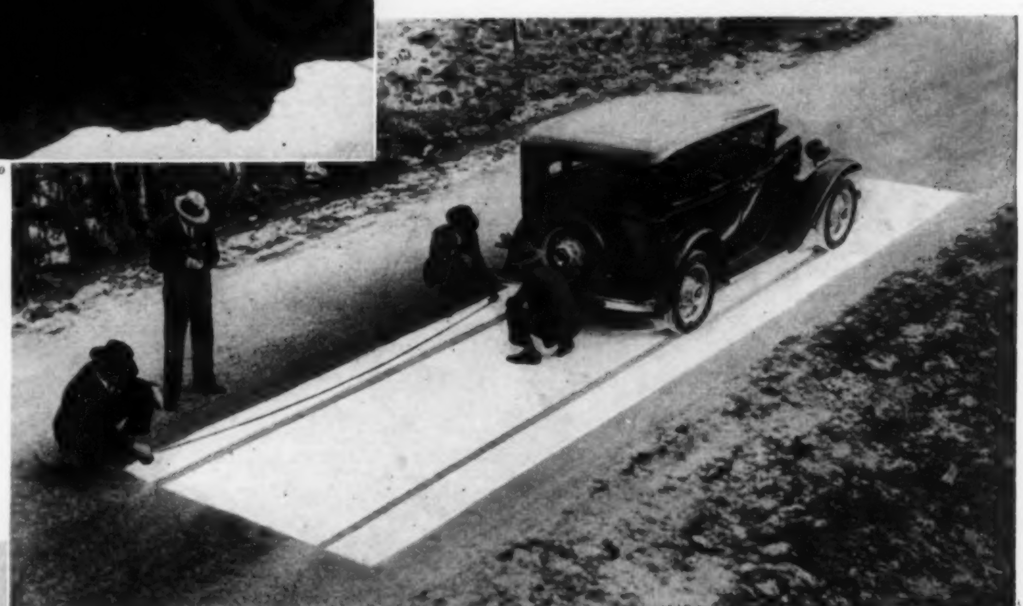
JOB ODDITIES

A Monthly Page of Unusual Features of Construction

FEATHERWEIGHT WHEELBARROW. Constructed entirely of aluminum, with the exception of the axle, this product of the Cleveland Wheelbarrow & Manufacturing Co., of Bedford, Ohio, weighs only 37 lb., about half the weight of the usual carrier of similar size. Overall dimensions are: length, 60 in.; width, 24 in., height, 29 in. Capacity, 3 cu.ft. of wet concrete or 4-5 cu.ft. of sand. Barrow tray is blanked out of 14-gage aluminum sheet; handles are tubing; wheel has roller bearings.

International Photo

"CAMERA!" Moving picture men shoot construction scenes at Hoover dam from special platform hung from cableway across Colorado River canyon.



STOPPED IN ITS TRACKS *(right)*. Non-skid properties of Warren bituminous penetration pavement tested in Georgia on stretch of road covered with limestone dust. Car going 40 mi. per hour was halted in length of 39 ft.

Wide World Photo

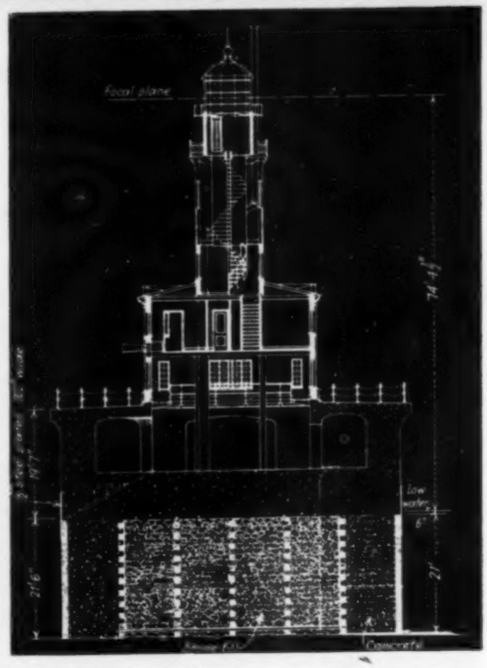
Is there an ODDITY on your job that should be illustrated on this page?

A TRIPLE HEADER *(left)* in grade separation construction. Near Worthington, Ohio, old Post Road passes under tracks of three different railroads.

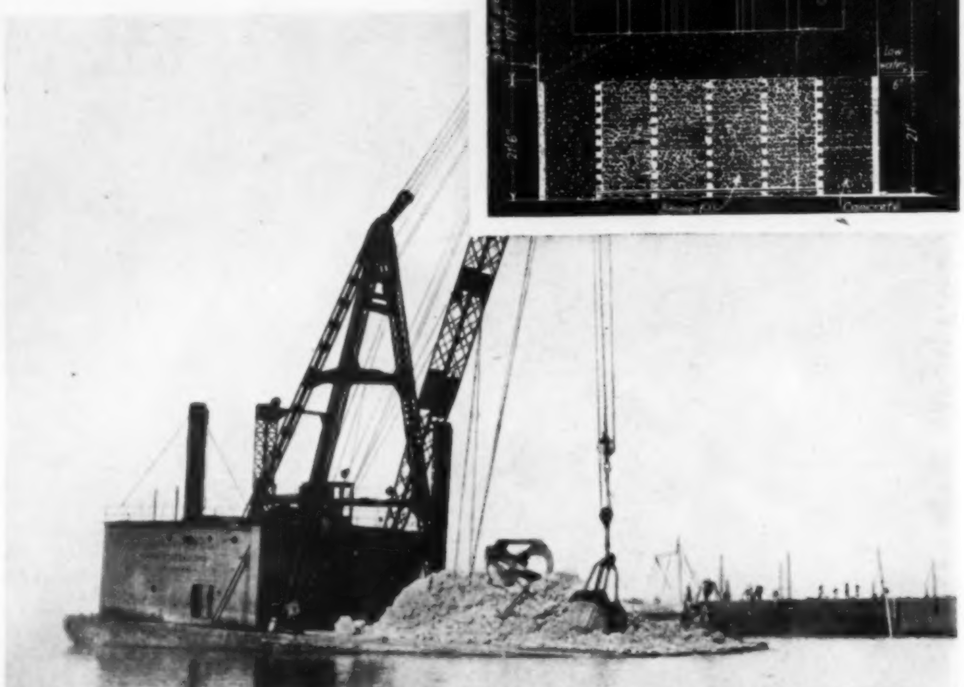
Lighthouse Built on STONE-FILLED CRIB

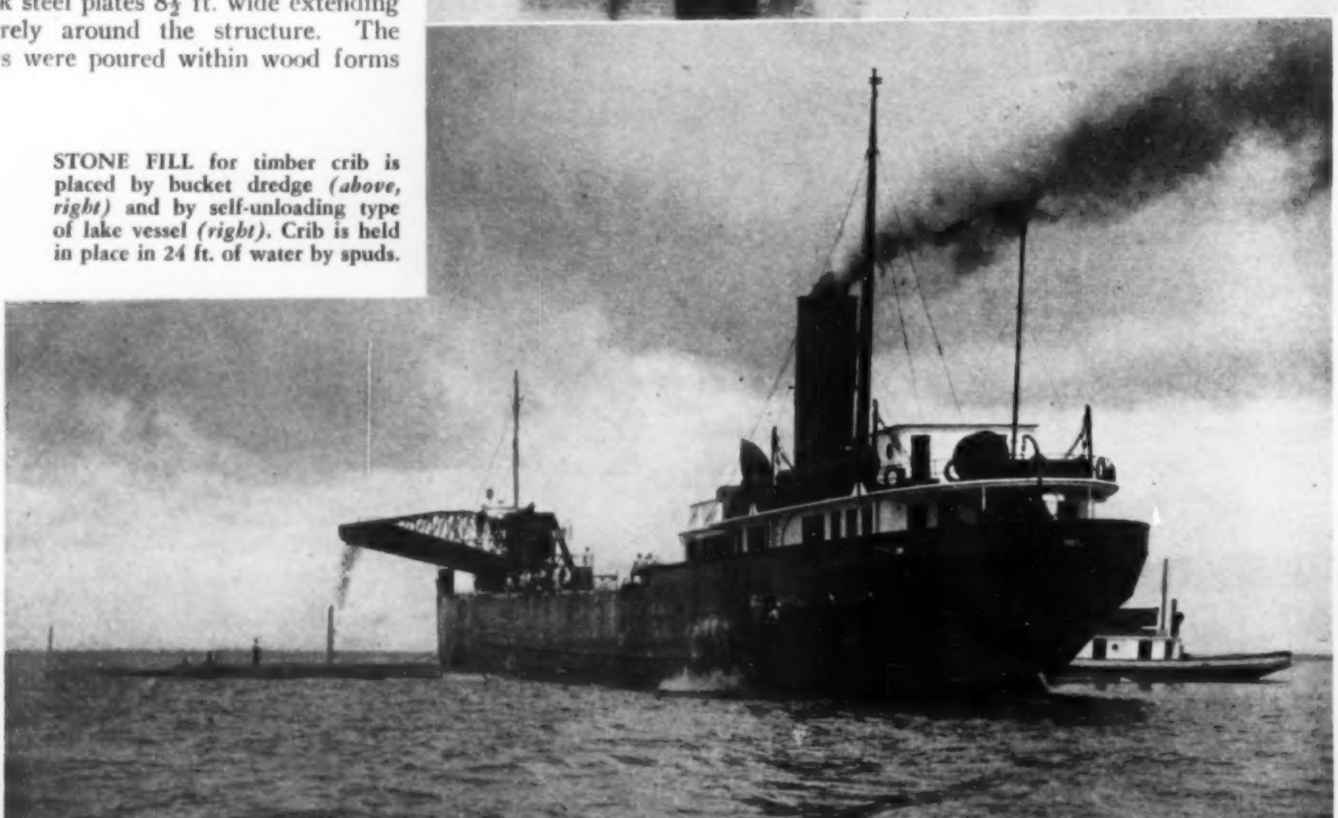
AFTER two years of difficult construction at an exposed submarine site one mile from shore the U. S. Lighthouse Service completed and placed in commission last November a new lighthouse at the outer end of Detour Reef in Lake Huron. The new station is at the mouth of St. Mary's River, connecting Lakes Huron and Superior, and replaces an old structure built in 1848. It is located in water 24 ft. deep upon a point close to the present deep water channel. The first step in constructing the new aid to navigation was the building, on shore, of a 60-ft. square timber crib, divided into compartments. After the crib had been launched and towed by tugs 10 mi. to the lighthouse site it was sunk on a prepared base by filling the inner compartments with rock and the outer compartments with concrete placed by tremie. The height of the crib is 21 ft., its top being about at the level of mean low water in the lake.

Upon this crib base of rock and concrete is built a concrete deck with walls rising 20 ft. above water and protected from ice damage by a band of $\frac{1}{4}$-in. thick steel plates $8\frac{1}{2}$ ft. wide extending entirely around the structure. The sides were poured within wood forms



STEEL TOWER ***(right)*****, carrying 100,000-cp. light 74 ft. above water, is supported on 60-ft. square stone-concrete-filled timber crib.**

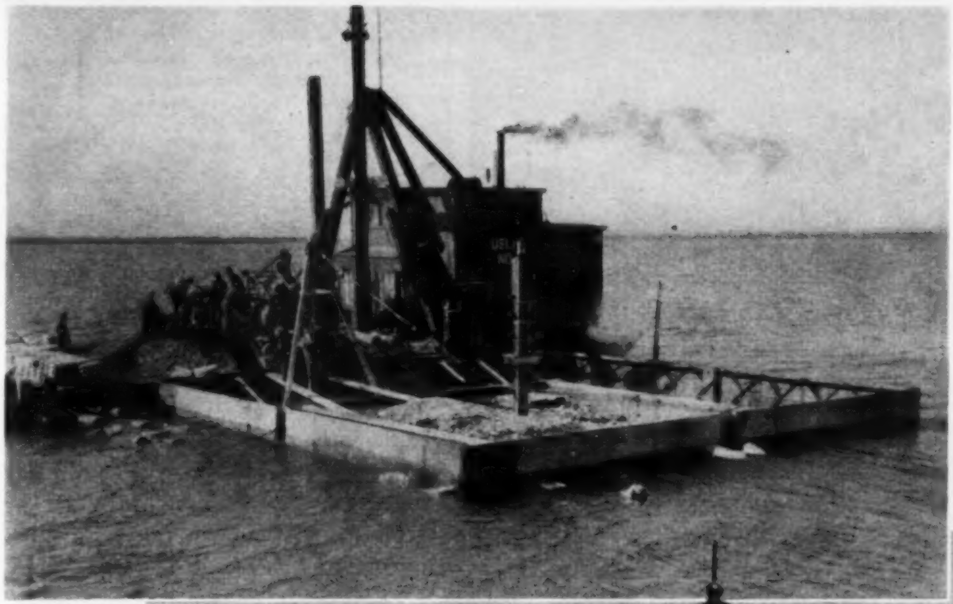




STONE FILL for timber crib is placed by bucket dredge ***(above, right)*** **and by self-unloading type of lake vessel** ***(right)*****. Crib is held in place in 24 ft. of water by spuds.**

ating machinery was completed. The total cost was approximately $140,000.

The erection of the new Detour lighthouse will provide mariners with an efficient beacon at one of the most important navigation points in the Great Lakes. In charge of construction for the Lighthouse Service were Charles A. Park, superintendent, and W. G. Will, assistant superintendent, of the Eleventh District at Detroit, Mich.

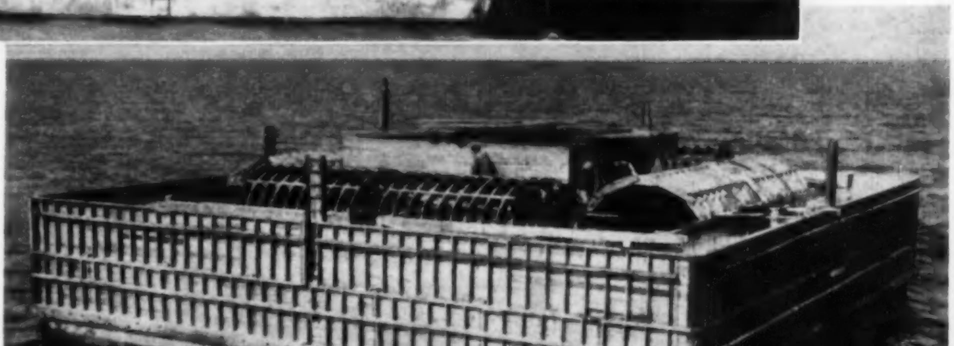


CONCRETE FILL *(left)* for outer sections of crib is placed by tremie. At water level band of steel plating ¼ in. thick protects crib walls from ice damage.

CONCRETE DECK *(above)* carries steel tower. Side walls flare outward at top to reduce force of waves and to throw water back from deck floor.

flaring outward near the top in order to break the force of waves and to throw the water back away from the deck. From the concrete deck rises a square steel tower carrying a 100,000-cp. light at an elevation of 74 ft. above water level.

During the first construction season the crib was built, sunk, filled with stone and concrete and covered with the concrete deck. October storms then made it necessary to suspend operations. Next year, however, the superstructure containing the light, quarters for the keepers and space for the oper-



WOOD FORMS in place for concreting side walls of deck structure. At center is pit to house machinery for operating fog signal and radio beacon.

SHOVELS TAKE OFF FIRST LIFTS of 230,000-yd. solid rock approach cut to west portal of new tunnel immediately alongside main-line running tracks.

Third of a series of articles on mainline tunnel improvements by the Chesapeake & Ohio Railway

Old Tunnel Paralleled by NEW C. & O. BORE

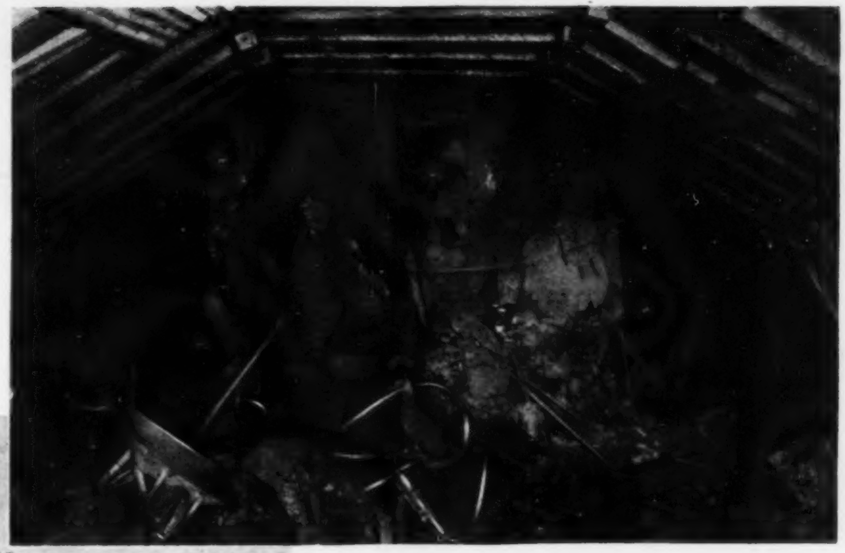
A MAJOR project in the extensive betterment program of the Chesapeake & Ohio Railway Co. through the mountains of Virginia and West Virginia is the 6,152-ft. single-track Big Bend tunnel, which parallels at a distance of 100 ft. an existing single-track tunnel built in 1872-1873. The old tunnel is only 15 ft. 2 in. wide and 16 ft. 10 in. high above top of rail, while the new bore inside its concrete lining will be 18 ft. wide and 23 ft. high above top of rail. The new tunnel will be used for eastbound traffic and such westbound equipment as may be too large for the old bore, the latter carrying all other westbound movements.

Construction operations started simultaneously at both ends of the project. An approach cut involving about 230,000 yd. of solid rock excavation had to be taken out at the west end before the heading could be turned under. By the time this excavation was completed, a 20,000-yd. rock cut at the east portal had been finished and the heading at that end was well advanced. About 70 ft. from the east portal, the heading encountered hard red shale; the west heading, on the contrary, was in soft, blocky shale for 600 ft. from

LIGHT, FULL-REVOLVING SHOVEL takes out upper lift, loading into motor trucks. Heavier equipment handles rest of excavation, 2½-yd. railroad-type shovels loading into 20-yd. air-dump cars on standard-gage track.

the portal. Hence, more heading was driven from the east than from the west end. For this reason, the mixing plant was located near the east portal, and the lining operations have been carried on from that end.

Top of slope of the west approach cut is 119 ft. above the rail. To get a start at that height, a full-revolving shovel, loading into motor trucks, took out a bench cut. From that bench cut on down, the rest of the rock was removed in 8-ft. lifts by a 2½-yd. railroad-type shovel loading into 20-yd. air-dump cars operated in ten-car trains on standard-gage track. Most of the spoil was handled through the old tunnel to make a fill on the east approach to the two tunnels.

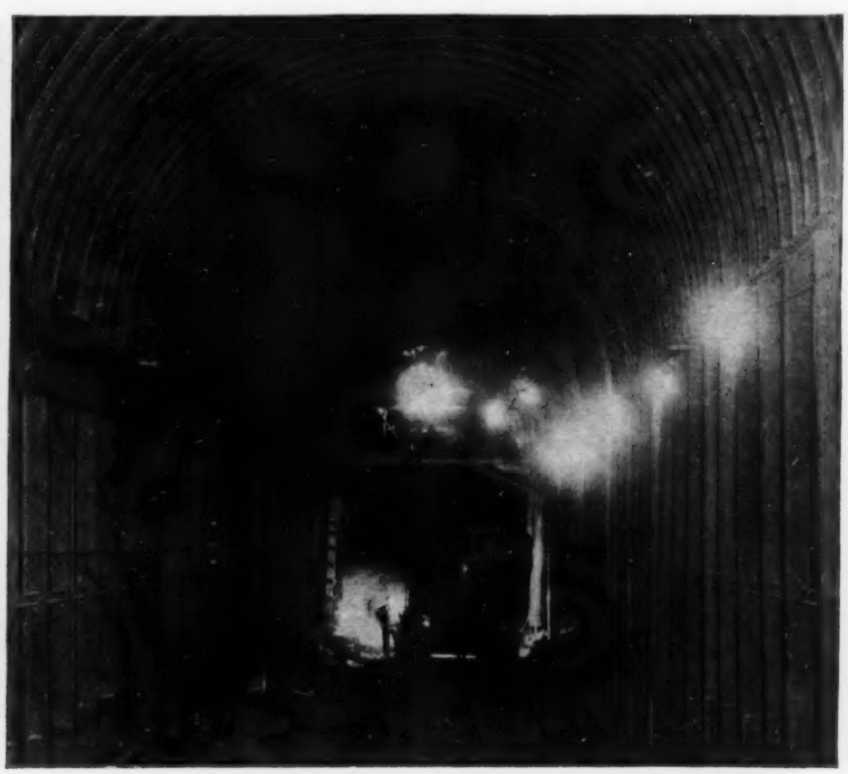


DRIFTS are advanced on both sides for wall plates of timbering in west heading. Seamy, unstable rock requires timbering to follow close to face of excavation.

EXCAVATION NEARS BOTTOM of west approach cut to new tunnel, with portal of old tunnel in close proximity.

Tunnel Driving—Tunnel excavation from the east portal was taken out in three lifts. The red shale encountered 70 ft. from that portal was sufficiently hard to permit a heading, down to the springing line of the roof and with a height of 12 ft., to be driven 75 to 90 ft. ahead before it was supported. The remainder of the section was taken out in two benches, the upper being 8 ft. and the lower 9 ft. in height. The heading and the two benches were carried forward together. Ordinarily, the heading and the bottom bench were fired at the same time, the top bench following immediately. More or less standard methods of drilling and firing

GOOD GROUND ar east portal makes it possible to take out heading and both benches without timbering until later.



STEEL-PLATE ARCH LINING AND STEEL PLUMB POSTS in good ground. In background, power shovel is working under scaffold car used in placing steel lining and packing arch ring.

were followed. Working in this manner, as much as 90 ft. of full section was driven in a six-day week.

Spoil from the east heading and benches was loaded into standard-gage 6-yd. dump cars which were handled in trains to the realignment fill on the east approach. An 8-ton storage-battery locomotive served the mucking shovel and shunted the cars to an outside assembly point, from which a gasoline locomotive handled them in trains to the dump.

Timber lining was used in turning under both the east and the west portals. Beginning 64 ft. from the east portal, structural-steel plumb posts and wall plates were placed to carry pressed-steel arch ring plates. Up to 2,000 ft. in from that end the bore was in material that stood well temporarily without danger of falls from the roof. This fact permitted the steel lining to be set after the excavation was some distance ahead and thus avoid damage to it from blasts. After the 2,000-ft. point was passed the shale became very soft, making it necessary to drift the steel wall plates ahead and to keep the lining right up to the excavation.

As fast as the drifts were advanced the wall plates were set on both sides of the heading. Steel dowel pins in the side walls supported these plates. Steel plumb posts were set under the wall plates as fast as the bench was removed, but the dowels were left in place, the load on the plates being only partly shifted to the plumb posts by shims. In case any of the plumb posts were displaced by blasts, the dowels held the plates and the arch liners.

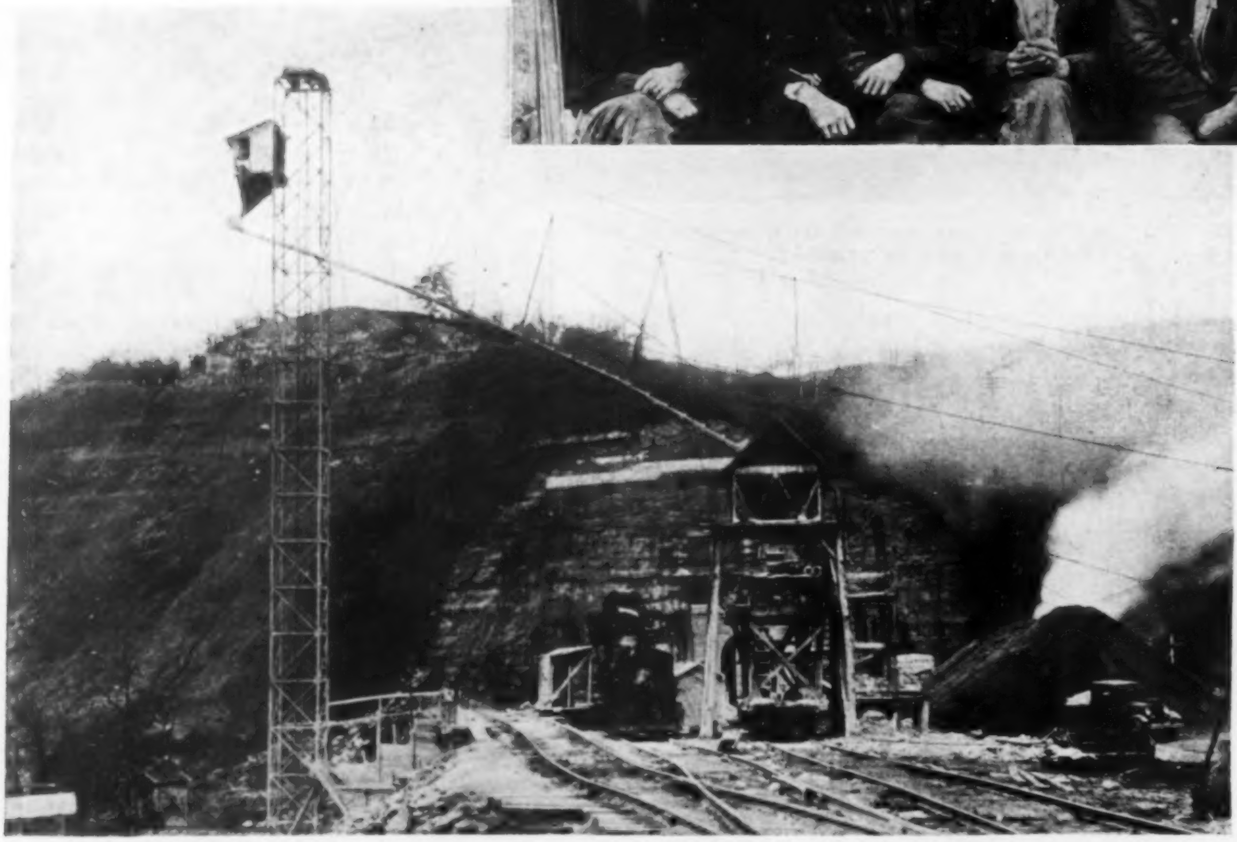
Some damage was done to the steel plumb posts where blasts had to be put off close to them. Otherwise, the steel lining worked out very satisfactorily when fairly good ground was encountered. This type of lining saved 2.7 yd. of excavation and 1.3 yd. of concrete lining per foot of tunnel, as compared with timber lining.

Bad ground was met from the beginning in driving from the west portal. Most of this was a seamy red or gray shale that air-slaked quickly when exposed. As a result, the heading had to be timbered heavily as it was removed. Timber wall plates were drifted in on both sides to permit the heavy timber arch rings to be set close to the working face.

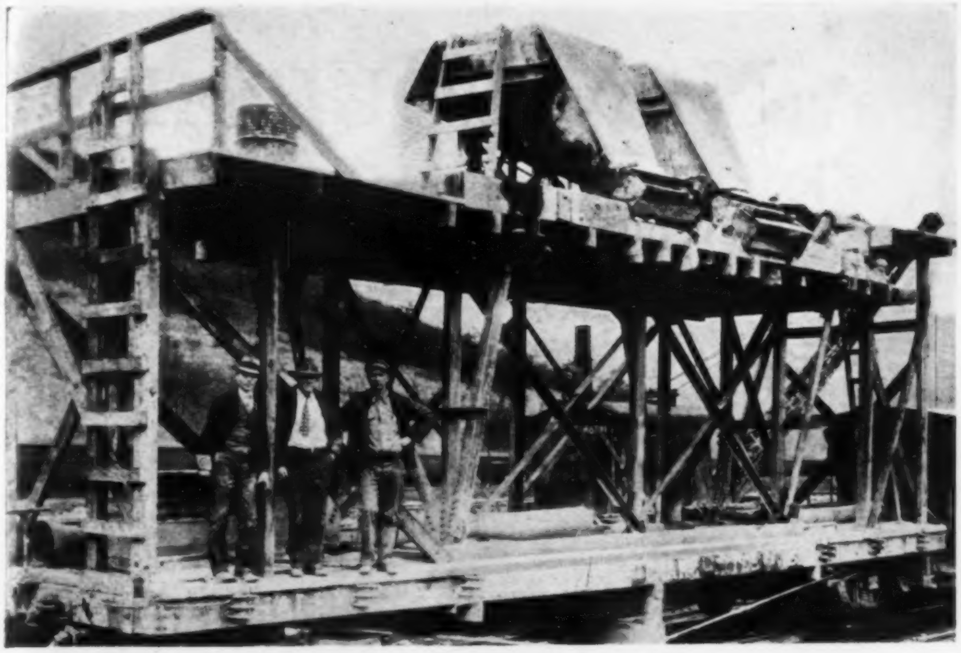
The heading was kept just in advance of the two benches in which the rest of the tunnel section was removed. Mucking was done with a 1-yd. power shovel loading into 4-yd. narrow-gage cars handled in trains to the outside by an electric mine locomotive.

Concrete Lining—Placing of the concrete lining was started from the east portal when the excavation from that end had been advanced 2,400 ft. Concrete work and excavation were conducted simultaneously thereafter. A properly-arranged schedule of pour-

ENGINEERING PARTY at Big Bend tunnel. *(Left to right front row)* D. W. PRESTON, C. B. PORTER, resident engineer, E. H. PERRY, F. W. WHEELER, R. H. REID. *(Back row)* A. S. MARSHALL, T. R. MORRISON, A. DEMPSEY, cook, W. R. DAWSON, and J. R. VAN HORN.



MIXING PLANT at foot of tower to left furnishes concrete for lining entire tunnel. Hopper cars used to shift concrete into tunnel are loaded from bin at right center spanning track leading to tunnel.



HOPPER CAR transports concrete from mixing plant to pour side walls of tunnel lining.

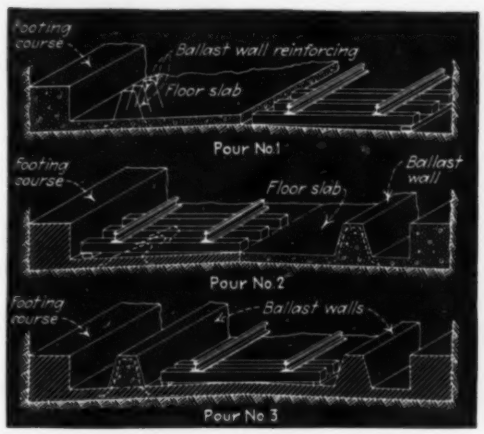
ing eliminated interference between the operations.

As indicated by the accompanying sketch, the first step in pouring the concrete was to shift to one side of the tunnel the track over which the muck trains operated. Then the floor slab on the other side of the center line and the footing course of wall were poured for a distance of 640 ft. At the same time, reinforcing rods for the ballast wall on that side were set as the concrete was poured.

When the first four had set for 9 days, the running track was shifted over on the floor slab, the projecting rods for the ballast wall being simply bent down and the spoil-train track ties shimmed up level over them. Then the other half of the floor slab, the ballast wall on that side and the corresponding side-wall footing course were poured for the same 640 ft. With this second pour properly set, the running track was shifted back to the center line of the tunnel and shimmed up on the finished floor slab. Then the reinforcing for the second ballast wall was bent up to its right position and that wall poured.

Two sections of movable steel forms, each 40 ft. long, were used in tandem in pouring the side walls and the arch. With a section of form in place on the previously poured footing courses, the side walls were first poured up to within 24 in. of the springing lines of the arch by gravity. Then the balance of the side walls and the arch were finished with a pneumatic placing outfit mounted just ahead of the form sections.

Location of the mixing plant at the base of a high approach fill near the



SEQUENCE OF POURS for floor, ballast walls and footing courses of side walls.

east portal permitted materials to be delivered to it by gravity from standard-gage cars on this fill. Concrete was hoisted in a tower skip from which it was chuted into an overhead bin spanning the track leading into the tunnel. Three different types of hopper cars were loaded by gravity from this bin.

One type of car had two portable hoppers set low enough to pour the floor, ballast walls and footing courses of the walls from either side of the car with a minimum of chuting. For pouring the side walls up to within 24 in. of the springing line, a second car was equipped with two hoppers set high enough to deliver through short chutes to forms at that height. Concrete was delivered to the pneumatic placing outfit by a car having two fixed hoppers which discharged only to one side. The concrete in the movable side-wall and arch forms was allowed to set a minimum of 36 hr. before these forms were shifted.

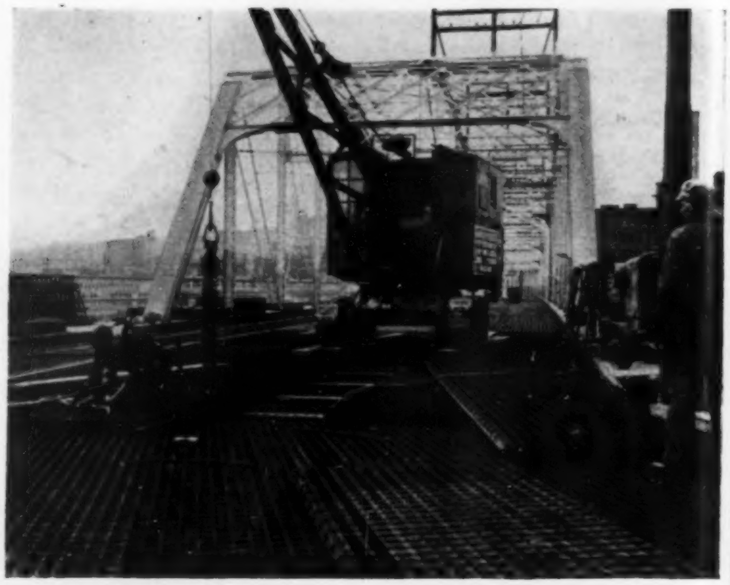
Electric power for the entire project was purchased from a public utility company. Compressed air was furnished by a motor-driven compressor plant near the east portal. All machines on the project, except the outside haulage locomotives, were electric motor-driven. Both headings were ventilated by forcing air into them through 20-in. Ventube from a motor-driven blower near each heading.

C. W. Johns is chief engineer of the Chesapeake & Ohio Railway Co., E. G. Rice is engineer of the district in which this project is located and C. B. Porter is resident engineer in direct charge. Haley, Chisholm & Morris, of Charlottsville, Va., are the general contractors, with J. R. Morris and L. P. Chisholm in immediate charge of operations. J. W. Tullah is superintendent on the east end and A. C. Goodwin on the west end of the project.

EAST PORTAL of Big Bend tunnel, which parallels older single-track tunnel 100 ft. away. Fabric air duct for ventilation can be seen at left.

NEW EQUIPMENT *on the Job*

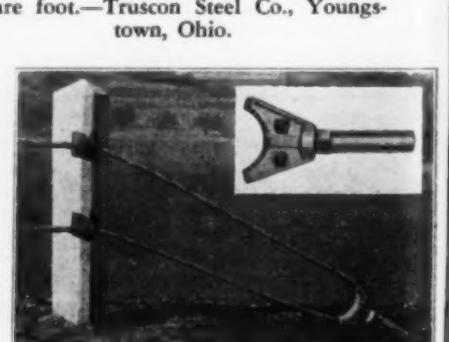
TRAILER-TYPE SPREADER used with light or heavy dump trucks for distributing light aggregates, calcium chloride, and other maintenance materials in highway work. Width of spread, 6 to 30 ft., is regulated by speed of air-cooled motor which operates spreader and assures uniform action regardless of speed of truck. Agitator blades in feed hopper of new Hercules-Ditwiler machine give material rotary motion, breaking up lumps. Spreader may be attached to truck in less than 1 min. Weight, 535 lb.—Ditwiler Mfg. Co., Galion, Ohio.



FOR BRIDGE FLOOR CONSTRUCTION Teegrid slabs of copper-bearing steel consist of structural tees placed side by side with their flanges welded together and with triangular crossbars, spaced 4 in. c. to c. pressure welded into tops of stems of tees. Space between stems of tees and beneath and around crossbars is filled with concrete. In resultant slab, which is secured to stringer supports by plug welds, bolts or rivets, steel and concrete resist compression and shear stresses; steel resists tension stresses. Slabs may be 4 ft. wide or less and any desired length. Any standard material may be used for wearing surface. Completed Teegrid floor is 3 in. thick and weighs 50 lb. per square foot.—Truscon Steel Co., Youngstown, Ohio.

ELECTRIC SAFETY SAW (*below*) 14 lb. in weight, has 6-in. blade with cutting capacity in wood from 0 to 1⅞ in. Cuts light lumber, rips flooring, makes and opens packing cases. With an abrasive disk it will cut or score tile, stone, slate and roofing materials. Safety features: momentary contact switch; swinging guard covering saw blade. Powered by Universal motor for 110, 150, 220 or 250 volts, as specified. —Stanley Electric Tool Co., New Britain, Conn.

PORTABLE DISK SANDER — GRINDER, with inbuilt vacuum system for picking up dust, designed specially for edging floors, but valuable in all other work where sanding equipment is needed. Powered by G-E. 1-hp. motor. — Porter - Cable-Hutchinson Corp., Syracuse, N. Y.



GUARD RAIL FITTING of malleable iron secures cables to anchor rods at end of span, equalizing strain of collision on cables. Sleeve or quill is internally threaded at lower end to receive threaded upper end of anchor rod. Circular external flange on upper end of sleeve is freely held within recess in frame which has a semi-circular inner surface for free engagement with looped end of guard rail cable. Hex-shaped section is cast on sleeve so it may be turned with a wrench upon threads of anchor rod and thus tighten or loosen both cables simultaneously. — Joseph H. Ramsey, 11 N. Pearl St., Albany, N. Y.

FOR DISTRIBUTING gravel, stone, sand, cinders and calcium chloride, G.S.C. Hi-Speed Spreader (*right*) may be attached to any truck without using special adapters. Handles any size material up to No. 3 crushed stone. Depth of spread controlled to range from light sprinkle to layer of several inches. Width of spread, 1 to 8 ft. After tarring or oiling operation, seal coat or dryer may be laid by operating truck backwards if desired.—Efficient Road Machinery Co., Inc., Syracuse, N. Y.

STEEL FLOORING (*right*) for bridge roadways consists of structural tees in combination with lighter flat bars mechanically interlocked with the tees and known as T-Tri-Lock. Standard units, in widths up to 4 ft. and lengths up to 40 ft., are placed directly upon bridge stringers. Secured by bolting, riveting, welding or clipping, and filled with concrete flush with tops of tees and cross-bars to form armored road surface. Wearing surface of concrete, asphalt or other suitable material may be added.—Carnegie Steel Co., Pittsburgh, Pa.

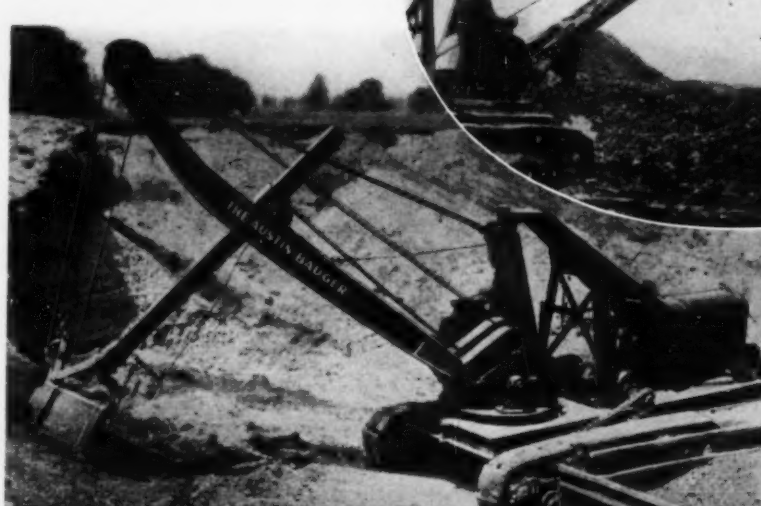
If You Want Further Information—

Within the space limits of these pages it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them, referring to this issue of *Construction Methods*.

PORTABLE CONVEYOR (*left*) handles stone, gravel, sand, cinders and other materials from hopper-bottom cars. Plate steel hopper with regulating valve provides full capacity gravity feed. Hopper is of $\frac{1}{4}$-in. plate steel with 3-in. angles riveted on each side to hook over railroad ties. Discharge height of conveyor regulated by hand-operated self-locking worm gear winch. Wheels mounted on roller bearing swivel-type axles. Belt is 24 in. wide with $\frac{1}{8}$-in. rubber cover on carrying side and $\frac{1}{16}$-in. cover on reverse side. Powered by 10-hp. Continental gasoline engine. Handles car of stone every 30 min., or 20 cars in 10-hr. day.—Jeffrey Manufacturing Co., Columbus, Ohio.

CONVERTIBLE SHOVEL, with 11-cu.ft. bucket, and with crane, clamshell, dragline, trench-hoe and backfiller attachments, can be utilized not only for excavating, but also for steel erection, form setting, pavement breaking, material handling and other construction activities. Powered with a McCormick-Deering industrial unit, including transmission having a number of speeds forward and one reverse. Can travel at speed of 4 mi. per hour, but is equipped with mounting of rubber-tired wheels for transportation behind truck at speed of 25 mi. per hour. Austin Manufacturing Co., 400 N. Michigan Blvd., Chicago, Ill.



Present and Accounted For —

A Page of Personalities

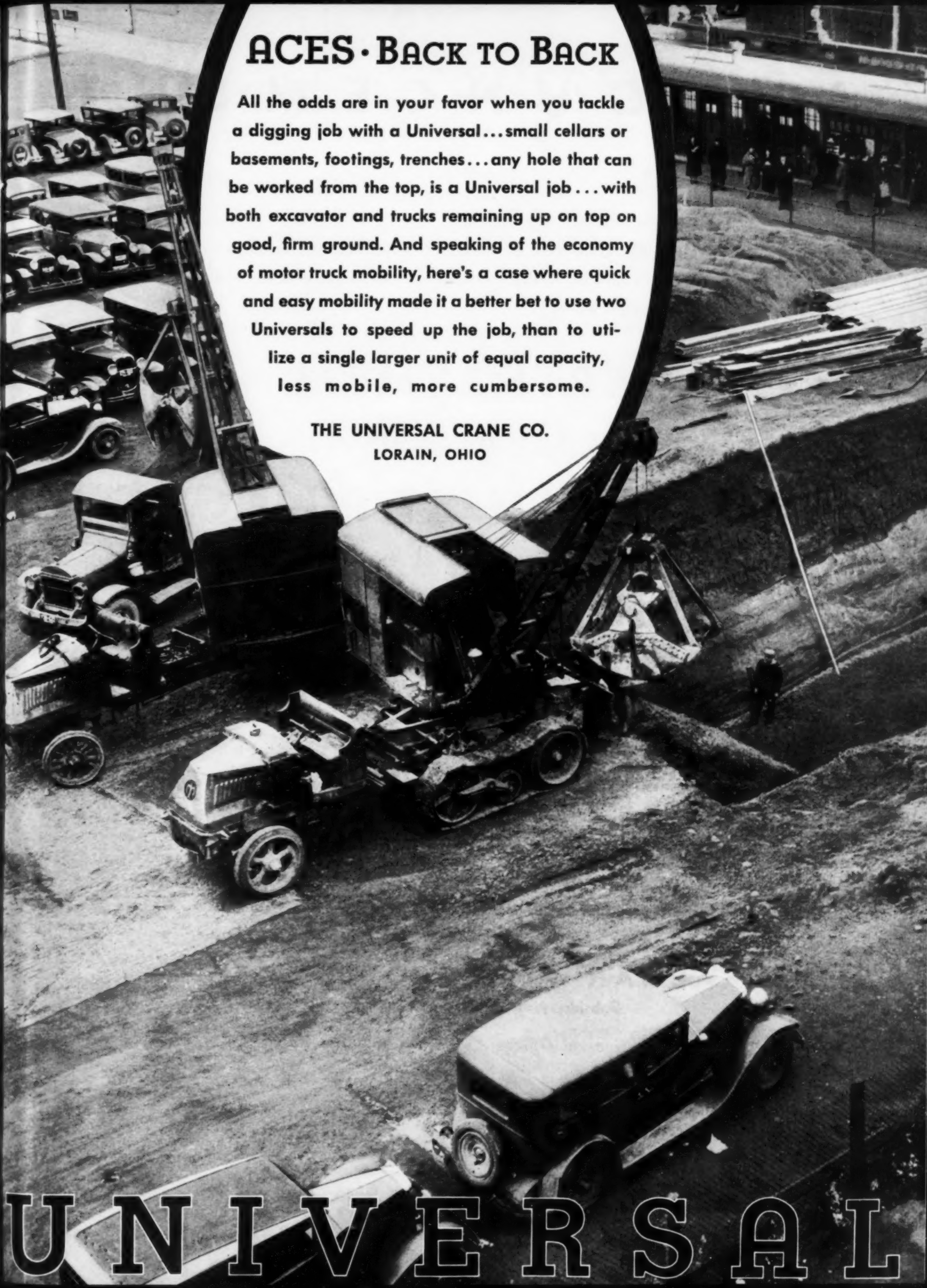
Wide World Photo

ENGINEERING BOARD OF REVIEW confers on problems of aqueduct constructon for Metropolitan Water District of Southern California (Left to right, seated). Frank E. Weymouth, chief engineer; Thaddeus C. Merriman, chief engineer, Board of Water Supply, City of New York; Arthur P. Davis, former director of U. S. Reclamation Service. (Standing) Prof. R. W. Sorenson, California Institute of Technology; Richard R. Lyman, consulting engineer, Salt Lake City, and Harvey S. Mudd, Los Angeles mining engineer and capitalist.

HENRY C. TURNER *(below)*, president, Turner Construction Co., New York, recently elected to honorary membership in the American Concrete Institute.

W. H. KIRKBRIDE has been appointed chief engineer of the Southern Pacific Co., succeeding the late George W. Boschke. He advances from the post of engineer, maintenance-of-way and structures.

PROF. S. C. HOLLISTER *(below)*, of Purdue University, is the newly elected president of the American Concrete Institute. Prof. Hollister heads the structural engineering department of the university's School of Engineering.


ACES · BACK TO BACK
All the odds are in your favor when you tackle a digging job with a Universal... small cellars or basements, footings, trenches... any hole that can be worked from the top, is a Universal job... with both excavator and trucks remaining up on top on good, firm ground. And speaking of the economy of motor truck mobility, here's a case where quick and easy mobility made it a better bet to use two Universals to speed up the job, than to utilize a single larger unit of equal capacity, less mobile, more cumbersome.
THE UNIVERSAL CRANE CO.
LORAIN, OHIO
UNIVERSAL

DS

Why we are selling
PREFORMED WIRE ROPE
in ever increasing quantities

During our 86 years in the wire rope business, we have developed many types of wire rope in order to meet severe and exacting demands of wire-rope-using equipment and machinery.

●

But prior to the perfection of the preforming process, there had been no basic improvement in wire rope. So long as wires and strands were forced to hold their helical shapes against a constant tendency to straighten out, there was internal stress—which in combination with normal bending stresses—was decidedly destructive.

●

Internal stress is eliminated in LAY-SET by preforming the strands and wires to the exact helical shape they assume in the finished structure. Strands and wires lie naturally in position, giving perfect strand balance—which greatly reduces probabilities of "high" and "low-stranding." Slippage on the drum is lessened, which is another of the many reasons for the longer service and better efficiency of LAY-SET Preformed Wire Rope.

●

While you may be receiving better satisfaction from Hazard non-preformed wire rope than from other brands of wire rope, you will obtain *still greater* service from LAY-SET Preformed Wire Rope of the same grade and construction.

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WILKES-BARRE, PENNSYLVANIA

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An interesting booklet which explains and illustrates 12 advantages of LAY-SET Preformed Wire Rope. Every wire rope buyer should read this booklet before ordering another foot of wire rope.

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Wilkes-Barre, Pennsylvania

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LAY·SET SAVES YOU MONEY

BECAUSE IT GIVES MUCH LONGER SERVICE

●

LAY-SET gives service which averages between 30% and 300% longer than given by non-preformed rope of the same grade and construction, the variation depending entirely on the nature of the work and type of equipment.

NOTE THE HELICAL SHAPE OF THE REMOVED STRAND

This illustration is made from an honest unretouched photograph. Note how you can remove a strand. You can turn it end for end and fit it back into position, which demonstrates the perfect balance of LAY-SET strands.

●

Note also that the ends need no seizing—there is no internal stress. Strands and wires lie naturally in position, free and relaxed.

See next page

Is
kid-resistance
IMPORTANT
?

utomobile deaths,
years ending 1921...58,552

utomobile deaths,
years ending 1926...98,551

utomobile deaths,
years ending 1931...152,732

—

152,732
AUTO DEATHS
IN 5 YEARS!

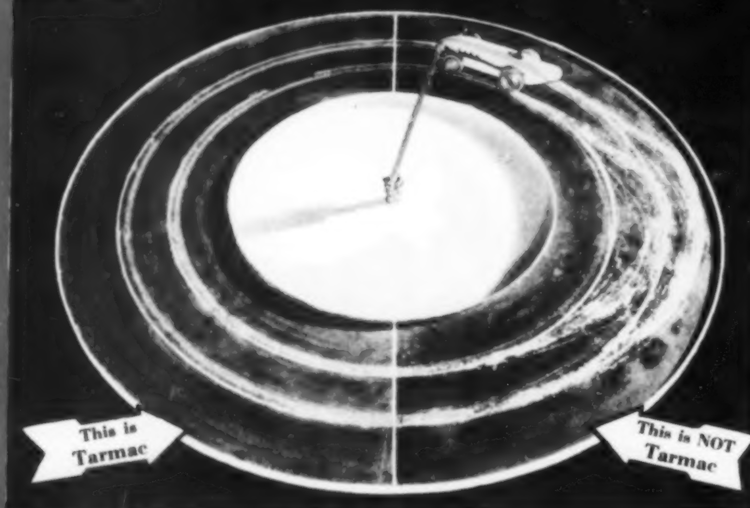
low many of these were
n your roads?

low many were due to
kidding?

low many lives would you
ave saved if your roads
ad a Tarmac surface?

We Repeat—
Is
kid-resistance
IMPORTANT
?

Tarmac roads stay skid-resistant because they are skid-resistant by nature. Surfaces that depend on "engineering technique" for skid-resistance grow slippery under traffic . . . .



Laboratory test for skidding. Half this track is paved with Tarmac; half with another material. Every effort is made to make the test fair. The automobile is self-propelled. *It skids every time it reaches the other material but straightens up on the Tarmac.* This is an actual un-retouched photograph. The tracks were made by allowing the wheels to pick up whiting.

There is nothing temporary about the skid-resistance of a Tarmac road; the surface is skid-resistant as long as the surface lasts.

There is no chance that it will fail to be skid-resistant; it does not depend upon special procedure in building or special engineering technique. It comes from inherent characteristics of Tarmac—

1. Tarmac in itself is less slippery than many other bituminous materials because it contains no slippery, oily constituents.

2. Tarmac penetrates into the road instead of bleeding up to the surface and this prevents the presence of surplus binding material on the surface. The road surface is therefore granular rather than slippery.

Use Tarmac and you will do better bituminous work . . . your roads will be safer; there will be less skidding; fewer accidents.

KOPPERS PRODUCTS COMPANY

KOPPERS BUILDING PITTSBURGH, PA.

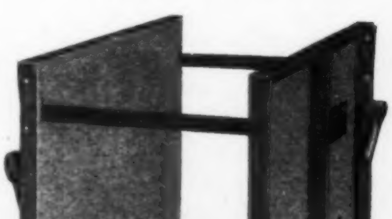
Tarmac *has* Infaration*

*Infaration is that quality of a bituminous material which causes effective penetration combined with maximum bonding power.

Circular or Straight Concrete Wall Construction is Most Profitable When "Metaforms" Are Used

Above: **Top, Circular Metaforms for bins, reservoirs, tanks, silos.**
Bottom: **Method of assembling circular Metaforms with steel truing spider.**

Below: **Metaforms for straight wall construction as used on above square rice warehouse.**



The best construction methods get required results easiest, quickest and at lowest costs. That is true in building either circular concrete tanks, bins, reservoirs or silos, or straight or angular concrete walls with "Metaforms"—steel unit forms.

Our illustration shows this. The circular bins and the square warehouse for the California Rice Association were photographed under construction with "Metaforms." The forms in place illustrate a day's construction progress with a minimum of equipment and labor. This Metaform method gets the very best results at very low cost.

If you work with concrete write today for latest Metaform Bulletins.

METAL FORMS CORPORATION, — MILWAUKEE, WIS.

Metaforms

Benson Street, Reading, Ohio. Paved with concrete in 1923.

This 9-year test proves the merit of

Carey Elastite EXPANSION JOINT

Unretouched photograph showing section of above pavement around expansion joint after 9 years service.

When this concrete pavement was laid in 1923, it was protected against expansion and contraction stresses by Carey Elastite Expansion Joint. Being a connecting link between two important highways, as well as the main village street, it is subjected to unusually heavy traffic.

The unretouched photograph at the left, taken in March, 1932, and showing a typical pavement section surrounding one of the expansion joints, is eloquent testimony to the durability of both concrete paving and Carey Expansion Joint.

Made with felt side walls which insure *uniform* resistance, Carey Elastite Expansion Joint has for 20 years proved its value and dependability in "making good paving better."

THE PHILIP CAREY COMPANY :: Lockland, Cincinnati, Ohio

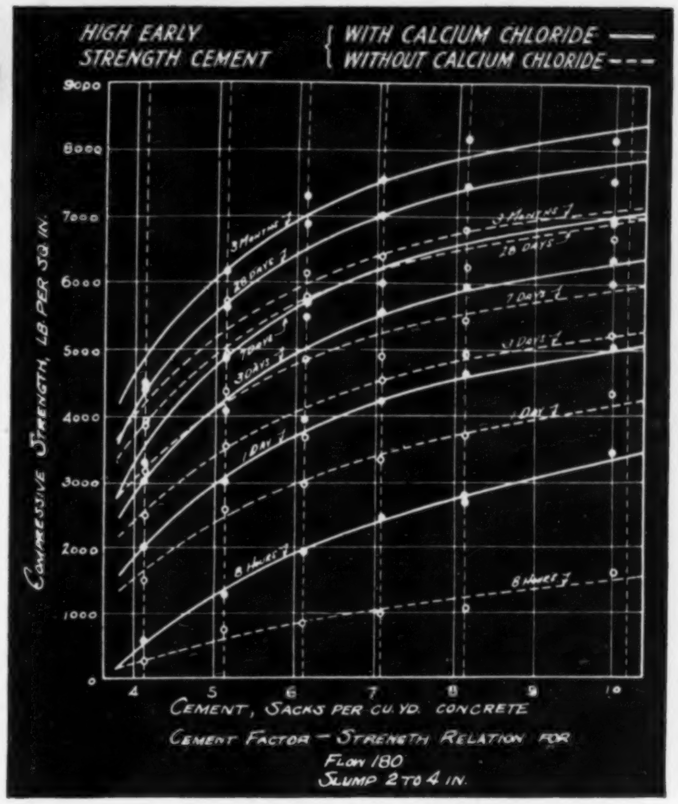
Branches in Principal Cities

BUILT-UP ROOFS
ASPHALT PRODUCTS
ELASTITE EXPANSION JOINT
WATERPROOFINGS
ROOF PAINTS

Carey PRODUCTS

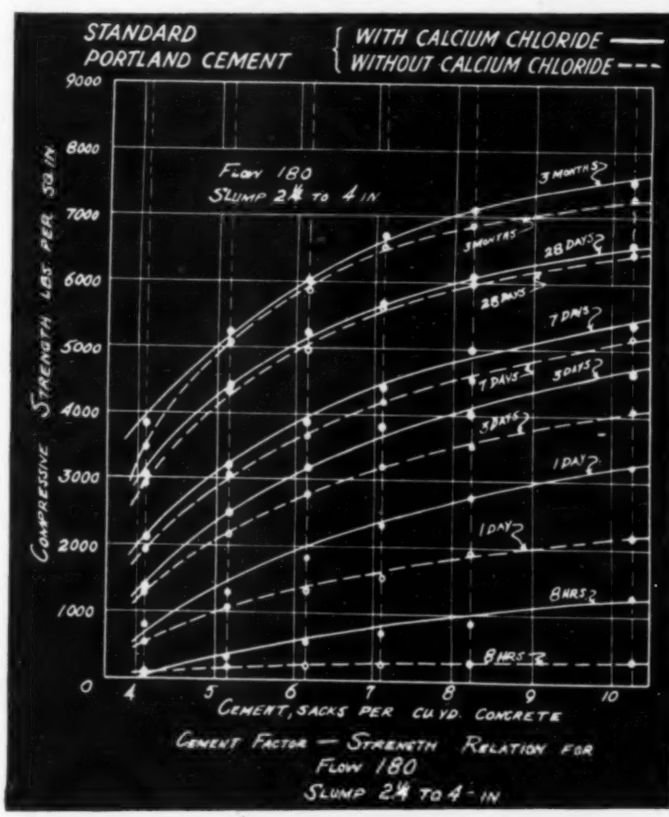
HEAT INSULATIONS
ASBESTOS MATERIALS
CORRUGATED ASBESTOS SIDING
ASFALTSLATE SHINGLES
ROLL ROOFINGS

SPEEDING UP FAST CEMENTS



NOTE the accelerating action of Calcium Chloride in tests of High Early Strength cement. Note that more than double strength is obtained with Calcium Chloride at 8 hours. Note approximately 20 per cent increase at one day, with uniformly higher strengths at 7 days — 28 days and three months. Here is definite evidence that Calcium Chloride speeds up any good cement—the high early strength kinds as well as the standard cements.

HASTENING THE ACTION OF GOOD STANDARD CEMENTS



Tests show four times the strength in standard cements at 8 hours when Calcium Chloride is included; nearly 50 percent strength gains at 1 day; uniformly stronger cement at 3 days, 7 days, 28 days, and three months, as compared to the same cements without Calcium Chloride.

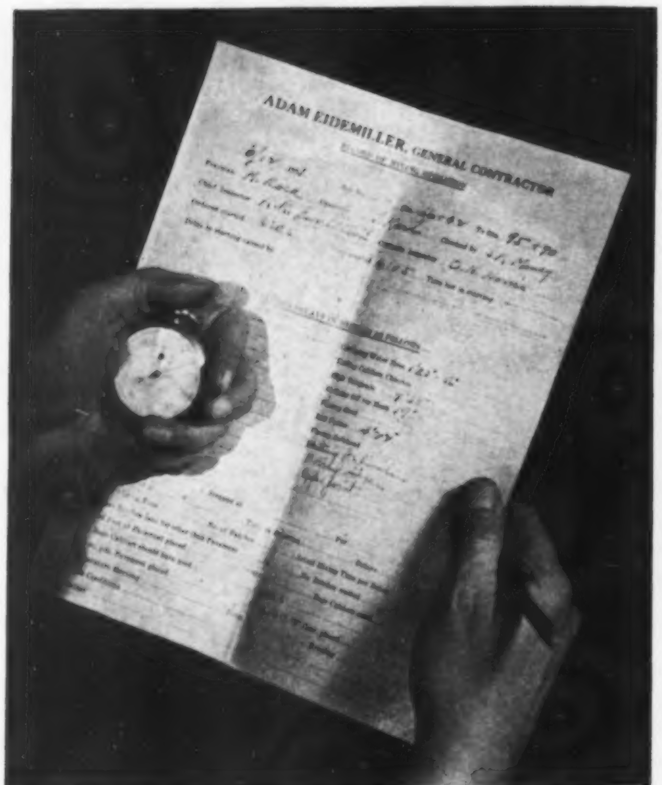
Write for full set of graphs showing extensive tests of the action of Calcium Chloride.

CALCIUM CHLORIDE ASSOCIATION

THE COLUMBIA ALKALI CORPORATION • Barberton, Ohio
SOLVAY SALES CORPORATION • 61 Broadway, New York City
MICHIGAN ALKALI COMPANY • 10 East 40th St., New York City
THE DOW CHEMICAL COMPANY • Midland, Michigan

CALCIUM CHLORIDE

FOR MODERN CONCRETE CURING



THE STOP-WATCH

Checks Losses!

Checks Up on Profits!

■

Read this excerpt from a Report by the U. S. Bureau of Public Roads:—

"On two Wisconsin jobs, daily production studies were made. . . . By stop-watch studies of key equipment for two or more hours every day, the effect on production and unit cost was determined"

No. 302 Time Study Timer

For Economy—
For Efficiency—
Use a Stop-Watch!

GUINAND

and

GALLET

STOP-WATCHES

ARE

STANDARD THE WORLD OVER

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Kindly forward catalog CM-5 on Stop-Watches for Road Use.

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Address....................City and State....................

Forward!

No more guessing

A Fairbanks Wheelbarrow Scale "on the job."

Concrete Mixing Advances with the Fairbanks Wheelbarrow Scales

The weighing of aggregate is a highly progressive step forward in the mixing of concrete. Accomplishing all the desired results of scientific mixing by engineers' formulae is made possible by the use of Fairbanks Wheelbarrow Scales. With them time and labor are saved, quality of concrete is safe-guarded, and absolute uniformity is assured. Hundreds of contractors are using these scales and meeting rigid specifications without increasing labor cost of mixing. There are three types of these scales. No obligation attends your inquiry for further details.

FAIRBANKS, MORSE & CO.

900 S. Wabash Ave., Chicago

And 40 principal cities—a service station at each house.

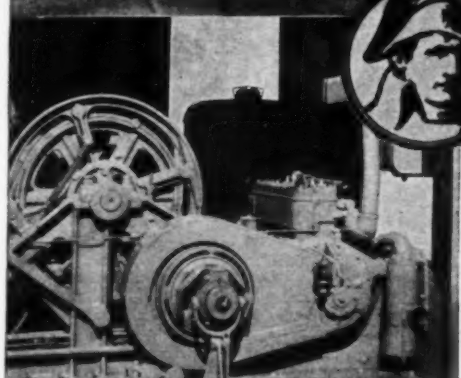
A three-ingredient Fairbanks Wheelbarrow Scale was used by this contractor in the paving of Main Street, Osceola, Wis.

This two-ingredient Fairbanks Wheelbarrow Scale weighed all stone and sand for the new bridge on Route 72 west of Genoa, Ill.

Fairbanks Scales

Preferred the World Over

5630-SA31.5



The GENERAL is powered with a husky six cylinder gasoline engine rated at 62 Horse Power when operating at conservative speeds.

90% of the weight of the GENERAL EXCAVATOR is of steel, heavily ribbed and braced. It has a single line pull of 12,000 pounds. Its speed is all that good engineering approves. It will do the same type of work as large machines.

The GENERAL EXCAVATOR enjoys a fighting reputation . . . It has EXTRA POWER and STAMINA that enables it to "tie-into" the toughest kind of jobs and come through with "big yardages" day after day. It is known among excavating men as the largest and most powerful half-yarder in the field.

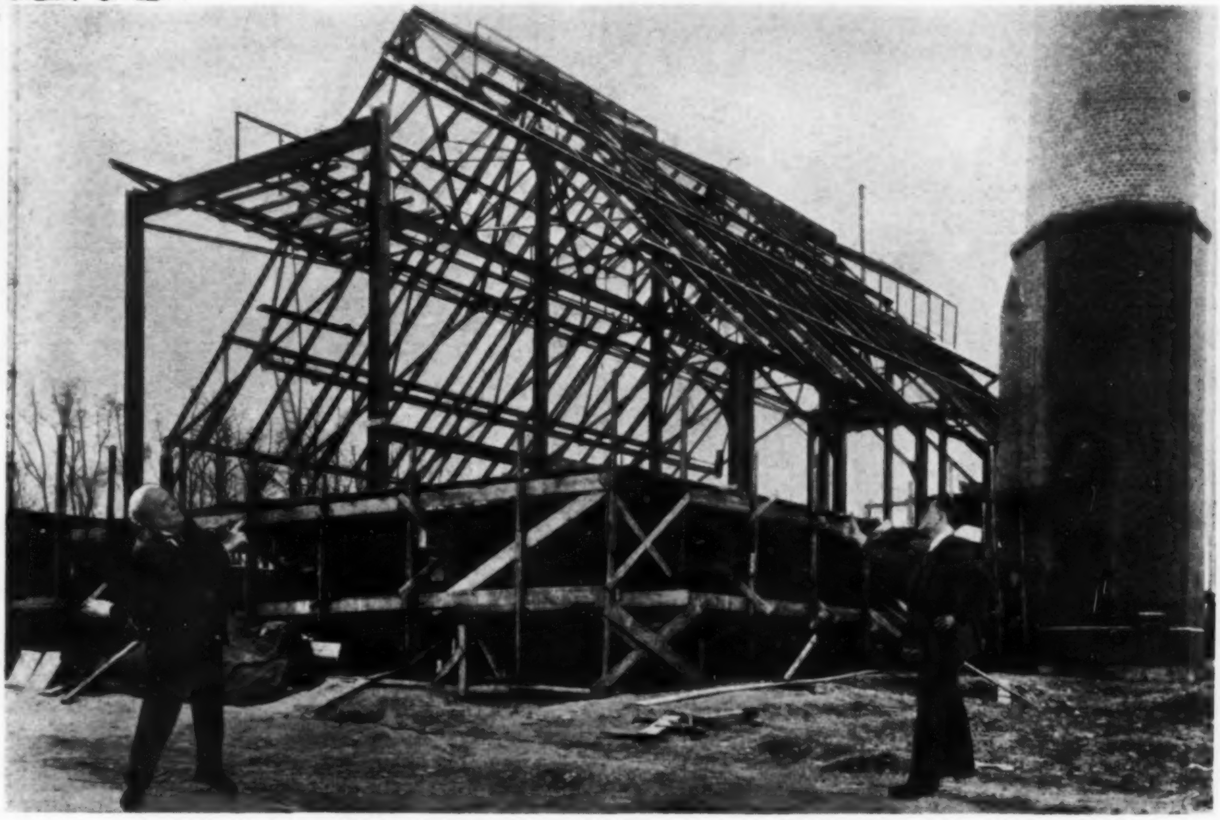
THE GENERAL EXCAVATOR CO., 375 ROSE STREET, MARION OHIO, U.S.A.

Anything in Your Way? Move It With

General EXCAVATORS

Shovel : Dragline : Pull Shovel : Skimmer : Clamshell : Crane : Magnet

POP AND LAD VIEW ARC-WELDED FRAMEWORK FOR POWER HOUSE



"Just take a look at the arc-welded frame of this power house. It was designed by Van Rensselaer P. Saxe, consulting engineer of Baltimore.

"They tell me this job was estimated on both riveted and arc-welded designs.

"Arc welding won out because it saved steel . . . saved time and labor in shop fabrication . . . saved time and labor in erection. Isn't that something?"

"It's everything . . . and do you know that this structure was arc welded in shop and field with Lincoln *'Stable-Arc'* welders?

"When you buy a *'Stable-Arc'* machine you get more than a welder . . . you get *guaranteed results.*

"Lincoln will furnish you a welder under a definite guarantee of welding speeds and costs.

"Be sure of what you're getting when you buy a welder. Take advantage of the guaranteed offer made by

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World

W-17

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Construction Methods, published monthly at New York, N. Y., for April 1, 1932.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared C. H. Thompson, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Construction Methods, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42d St., N. Y. C. Editor Robert K. Tomlin, 330 West 42d St., N. Y. C. Managing Editor, None. Business Manager, Willard Chevalier, 330 West 42d St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42d St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42d St., N. Y. C. James H. McGraw, Jr., 330 West 42d St., N. Y. C. James H. McGraw, James McGraw, Jr., and Malcolm Muir, 330 West 42d St., N. Y. C. Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw. Curtis W. McGraw, 330 West 42d St., N. Y. C. Donald C. McGraw, 330 West 42d St., N. Y. C. Anne Hugus Britton, 330 West 42d St., N. Y. C. Mason Britton, 330 West 42d St., N. Y. C. Edgar Kobak, 330 West 42d St., N. Y. C. Grace W. Mehren, 33 West Grand Ave., Chicago, Ill. J. Malcolm Muir and Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 524 Fifth Ave., N. Y. C. F. S. Weatherby, 271 Clinton Road, Brookline, Mass. Midwood Corporation, Madison, N. J. Stockholders of which are: Edwin S. Wilsey, Madison, N. J. Elsa M. Wilsey, Madison, N. J.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.)

C. H. THOMPSON, Secretary.
McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 31st day of March, 1932.

[SEAL] H. E. BEIRNE,
Notary Public N. Y. Co. Clk's No. 203, Reg. No. 3B102. Kings Co. Clk's No. 636, Reg. No. 3129.
(My Commission expires March 30, 1933)

SALESMAN AVAILABLE

SALESMAN, calling on plumbing and heating dealers, architects, etc., in Wilkes-Barre, Pa., and vicinity for fifteen years, is available for side lines.—Building hardware specialties, etc. SA-104 Constr. Methods, 330 West 42d St., New York.

FREE BULLETIN

STOCK LIST No. 134—"ECA Rebuilt" Construction, Industrial and Material Handling Equipment, just issued by the Equipment Corporation of America, 1150 So. Washtenaw Ave., Chicago, Ill. Items classified, 34 pages, size 4x9. It is stated that company is in its 29th year, that their prices are the lowest in 15 years, and that all items listed are owned and may be inspected at one of their three plants in Chicago, Pittsburgh or Philadlphia.

ALPHABETICAL INDEX TO ADVERTISERS

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The New Firestone ROAD BUILDER

HERE is a new tire designed specifically for use on tractors and road graders. Built for severe operating conditions with a new tread that hangs on to the road and digs through. Sharp-edged, self-cleaning tread. No side slip. Toughened to withstand the hardest going.

Greater Traction

Gum-Dipped Cords which give extra strength. Two Extra Cord Plies Under the Tread which give 26% greater protection against punctures and blowouts and 56% stronger bond between tread and cord body.

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